Contribution of Non -timber Forest Products (NTFPs) in Household Livelihood in the Rural Areas Of Shiekan Province, North Kordofan State, Sudan

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DEDICATION

To My Mother,

with deep and sincere love

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Abbreviations

ADS:	Area Development Scheme
ATI:	Appropriate Technology International
CFAN:	CIDA Forestry Advisers Network.
CITES:	Convention on International Trade in Endangered Species
FAO:	Food and Agriculture Organization of the United Nations
FNC:	Forest National Corporation
FOSA:	Forestry Outlook Study for Africa
FRA:	Global Forest Resources Assessment
NTFPs:	Non-timber forest products
NWFPs:	Non-wood forest products
UNSO:	The United Nations Sudano-Sahelian office
UNCED:	United Nations Conference on Environment and Development

Abstract

The general objective of this study was to investigate the contribution of non-timber forest products (NTFPs) to the livelihood of households in rural areas of Shiekan Province in North Kordofan State. Specifically the study aims at: a) identification of categories of beneficiaries and their social characteristics related to collection, use and marketing of NTFPs; b) exploration of the relationship between certain socioeconomic factors on the one hand and collection, use and marketing of NTFPs on the other hand; c) identification of socioeconomic factors that influence the household decision to participate in the collection of NTFPs and use of services. Data were collected using a social survey of three groups of respondents, namely households, informants and traders. Stratified multistage sampling method was used followed by random selection of the sample for the first group while purposive sampling was used for the other two groups. Summary information of the socio-economic characteristics of the study sample was obtained in form of frequency, percentages, distribution and cross-tabulation. Pearson chi-square for cross tabulations was used to determine the significance of the relations among different variables in the cross- tables. Means separation for the collected quantities of the different products in the study area was obtained using one- way analysis of variance and post hoc tests (LSD). The probability of the household's participation in the collection of NTFPs and the factors affecting it were studied using the non-linear binary logistic regression model. The results of the study showed that, farming was the major activity throughout the rain fed study area. Non-timber forest products activities provide one of the potential alternative occupations during the slack period. More over division of heads of households into gender shows that females are also heads of households by a percentage quite near to that of males. Fuel wood appeared as one of the most important NTFPs for the households in the study area it constituted the major source of energy for them. In general, in addition to fuel wood thirty-four NTFPs were collected and used consumed or marketed by households in the study area although variations occur among different households as social factors vary. The most important of these products, depending on the count of collectors, are the products of the following species: *Zizyphus spina-christi, Balanities aegyptiaca, Adansonia digitata, Acacia nilotica,*

Tamarindus indica, *Cassia senna and Grewia tanex* (Nabag, Laloub, Gunglaize, Garad, Aradieb, Sannamaka and Gudiem, respectively). The common collection system practiced in the study area under rights bestowed was for utilization at home level and sale in the local markets. The study also showed that a number of socioeconomic factors are related to collection and marketing, in particular, gender is an important factor. NTFPs are common property in the communal land, while they are private in family land. The fruit was the main part used also the leaves, seeds, branches, flowers, stems, and roots were used. The main uses were confined mainly in food, drink, fuel and medicine. Forage, cosmetic and some home industries also mentioned as uses.

The households get revenue or some income from selling NTFPs. Markets are dispersed and of ephemeral nature. The bulk of trade was local between households and traders.

All estimated models have high prediction power of classification (observations correctly classified) and the models have a good explanatory capacity (R^2) of more than 75%, except in the case of *Garad* which is 55%. The explanatory variables included in the models are jointly of high significance (0.00) as reflected by the Chi-squire statistic.

The significance of the factors affecting the decision to collect NTFPs varies from one product to another different factors are significant in the decision to collect. Recreation is identified as one of the services provided by woodlots and forests. For participating in recreation, however two factors were significant, namely the position of respondent in the household (whether a head or not) and the village which indicates the proximity of the recreation facility. Collection of NTFPs was perceived by many respondents as facing certain constraints. The most frequently cited constraints are long distances to be traveled to get them and the pest and diseases affecting the products. Also the thorny nature of the trees was mentioned as a limiting factor as well as difficulty in collection (which might be related to thorny nature) and limited quantities of the products. Another group of constraints of less importance were said to be found.

The study shows that the main constraints facing the marketing of the NTFPs in the study area are the low prices of the products and lack of the transportation means. The study concludes with recommendations of managerial and policy implications.

خلاصة الأطروحة

أجري هذا البحث في محافظة شيكان بولاية شمال كردفان لدراسة مساهمة منتجات الغابات غير الخشبية في معيشة الأسر في المناطق الريفية. تهدف هذه الدراسة للتعريف بالفئات المستفيدة ومعرفة خصائصهم الاجتماعية المتعلقة بجمع منتجات الغابات غير الخشبية واستعمالها وتسويقها . أيضاً تهدف الدراسة إلى تحديد العوامل الاقتصادية والاجتماعية التي تؤثر علي قرار الأسر في المشاركة في جمع منتجات الغابات غير الخشبية واستعمال الخدمات الأخرى المتاحة منها.

تم جمع البيانات باستخدام المسح الاجتماعي لثلاثة مجموعات من المستجيبين وهم الأسر، المسئولين والتجار. واستخدم منهج العينة الطبقية متعددة المراحل وتم إتباعها بالاختيار العشوائي لأخذ عينة الدراسة من المجموعة الأولي بينما تم اختبار العينات من المجموعتين الأخريتين باستخدام العينة الغرضية. استخدم نظام التحليل الوصفي ، تحليل التباين والنموذج اللوجستى للانحدار الثنائي لتحليل البيانات.

وقد أبانت الدراسة أن الزراعة هي النشاط الرئيسي الذي يقوم به المواطنون في المناطق المطرية من منطقة الدراسة وتمثل أنشطة منتجات الغابات غير الخشبية واحدة من البدائل الواعدة في فترات الركود كما أبانت الدراسة أيضاً أن عدد أرباب الأسر من النساء يقارب عدده من الرجال. وأوضحت الدراسة أن حطب الوقود كأحد أهم منتجات الغابات غير الخشبية يمثل المصدر الرئيسي للطاقة لهذه الأسر في منطقة الدراسة، كما وجد انه بجانب حطب الوقود فان الأسر في منطقة الدراسة يقومون بجمع واستخدام وتسويق أربعة وثلاثون نوعاً من هذه المنتجات مع التباين بين هذه الأسر في جمع واستخدام هذه المنتجات بتباين العوامل الاجتماعية. استناداً علي عدد الأسر الذي يقوم بجمع هذه المنتجات فإن أكثرها أهمية هي، النبق، القنقليز، اللالوب، العرديب، السنامكة، القرض والقضيم علي التوالي ويتم الجمع عامة للاستعمال علي مستوي المنزل وللبيع في الأسواق المحلية. وقد أوضحت الدراسة أيضاً أن النوع يمثل احد العوامل الهامة التي لها علاقة مباشرة بعمليات الجمع والتسويق.

أوضحت الدراسة إن جمع منتجات الغابات غير الخشبية من أراضي الأسرة يكـون خاصتها إلا بإذن لغير أفراد الأسرة وأن الجمع يكون متاحاً للجميع من الأراضـي القفـار والتي تمثل ملك مشاع لكافة أفراد المجتمع. وقد أبانت الدراسة من ناحية أخري أن جميع من يقومون بجمع هذه المنتجات يستهلكون جزاءاً منها ويتم تـسويق نـسبة كبيـرة منهـا ويتحصل المنتجين على بعض الدخل منها. تركزت الاستعمالات في الطعام، الشراب الطاقة والدواء، كما ذكر البعض استخدامات أخري كأعلاف، مـواد زينـة ومـدخلات لـبعض الصناعات الصغيرة. ولقد وجد أن الأجزاء المستعملة هي الثمار، الأوراق وهناك أجـزاء أخري ذكر استعمالها بنسب بسيطة مثل البذور، الفروع اللحاء الجذور والأزهار. وجـد أن أسواق هذه المنتجات متفرقة وتتسم بالبدائية وعدم الانتظام ويتم التسويق محلياً داخل القرية أو في أسواق القرى المجاورة وسوق مدينة الأبيض. ويتم التبادل بين المنتجين والتجار أو الوسطاء.

أوضحت الدراسة إن نموذج الانحراف اللوجستي الثنائي له القـدرة العاليـة علـي التصنيف كما أن له قدرة تفسيرية عالية تجاوزت نسبة 75% لكل المنتجات ماعدا القرض.

كما وجد أن العوامل الاقتصادية والاجتماعية تؤثر علي قرار مشاركة الأسر فـي جمع منتجات الغابات غير الخشبية بنسب متفاوتة ولقد ذكر المستجيبون أن الاستجمام هـو أحد الاستخدامات التي يستفيد منها الأسر من هذه المنتجات ووجد أن عاملين يؤثران إيجاباً في حالة الاستجمام هما موقع المستجيب في الأسرة وموقع القرية.

وقد ذكرت الأسر مجموعة من المعوقات التي تواجههم في عملية الجمـع أهمهـا: المسافات الطويلة، الحشرات والأمراض التي تؤثر علي هذه المنتجات كما أن هناك طبيعة الأشجار الشوكية وصعوبة الجمع والكميات المحدودة.

أما المعوقات التي تواجه تسويق هذه المنتجات فقـد تمثلـت فـي الأسـعار المنخفضة وانعدام وسائل المواصلات.

وقد اختتمت الدراسة ببعض التوصيات الإدارية والسياسية.

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Summary

This study was carried to see the contribution of non-timber forest products (NTFPs) in households' livelihood in rural areas of Shiekan Province in North Kordofan State. The study covers all available NTFPs excluding gums and resins as these have been subject to relatively more intensive research.

Specifically the study aims at identification of categories of beneficiaries and their social characteristics related to collection, use and marketing of NTFPs.

Exploration of the relationship between certain socioeconomic factors on the one hand and collection, use and marketing of NTFPs on the other hand. This includes exploring the gender dimension of NTFPs perception of beneficiaries on benefits of NTFPs, types, quantities, sites and sources of collection of NTFPs as well as methods of harvest, treatment and utilization.

Identification of socioeconomic factors that influence the household decision to participate in the collection of NTFPs through estimating binary logistic models for each product or service.

The data were collected using a social survey. Three groups of respondents were surveyed, households, informants and traders.

For the first group standard statistical method for sample selection was used, thus a stratified multistage sampling method was used followed by random selection of the sample within each stratum.

As for the informants and traders a purposive selection method was used.

Data obtained from the household questionnaire were analyzed using the Statistical Package for Social Surveys (SPSS).

Descriptive statistical methods were applied to data concerning social characteristics and respondents perspectives about the different aspects of the NTFPs production activities.

Summary information of the socio-economic characteristics of the study sample was obtained in form of frequency, percentages, distribution and cross-tabulation. Pearson chi-square for cross tabulations was used to determine the significance of the relations among different variables in the cross- tables.

Means separation for the collected quantities of the different products in the study area was obtained using one- way analysis of variance and post hoc tests (LSD).
The probability of the household's participation in the collection of NTFPs and the factors affecting it were studied using the non-linear binary logistic regression model.

The findings showed that:
Farming was the major activity throughout the rain fed study area. Non-timber forest products activities provide one of the potential alternative occupations during the slack period.

Most of the population is illiterate regardless of gender. More over division of heads of households into gender shows that females are also heads of households by a percentage quite near to that of males.

The common collection system for the NTFPs usually harvest in the study area practiced by the local households under rights bestowed, was for utilization at home level and sale in the local markets.
The surveyed households in the rural areas of Shiekan Province perceive these NTFPs in different ways while 130 of them mentioned the food, 109 said traditional medicine, 104 mentioned fuels, income by 98, 94 of the respondents mentioned combat desertification, and 64 household perceive them as shade.
The findings showed the fuel wood as one of the most important NTFPs for the respondents in the study area it constituted the major source of energy for the households in the rural areas of Sheikan province, where almost all the respondents depend on fuel wood in their daily life uses, and charcoal appeared as a secondary source.
As for the other non-timber forest products found in these rural areas the study revealed that, the surveyed households in the 27 villages of the study area commonly gathered and used thirty-four (34) types of NTFPs that mentioned to be found there. But, when going through these species thoroughly, it was evident that these products vary with the number of households, according to the types mostly extracted and dealt with. Of these, *Zizyphus spina-christi, Balanities aegyptiaca, Adansonia digitata, Acacia nilotica,Tamarindus indica, Cassia senna and Grewia tanex (Nabag, Laloub, Gunglaize, Garad, Aradieb,*

Sannamaka and Gudiem respectively.), were found to be of the most significant importance as they heavily gathered and used by the different communities at Shiekan rural areas. This was indicated by the large number of families documented to be involved in the collection of these specific species.

Regarding the distribution of these products in the study area and their accessibility for the people in these areas, the results showed the presence and distribution of these resources all over the surroundings of these villages, inside the villages [*Balanities aegyptiaca*] and within the agricultural lands, whether they were *familylands* or *ghifarlands* and they represent the major site for these products in this region. Some of them were also found in forests whenever they found in the study area (natural, planted, reserved or unreserved, governmental or community forests). However, it could be said that these sites supply the inhabitants in the study area by different amounts of different available NTFPs.

However, the survey results indicated that, the collection of NTFPs from the *ghifarland* was a common property to all inhabitants of the study area, where every one in the community has free access to the trees in these lands throughout the year. where as for the family land, the NTFPs, the trees and their products are deemed to be a family property, this means that the family has the right to collect these tree products and control other peoples' access to that specific land unless they have permission. This clearly reflects the land tenure system prevailed in Shiekan province where the usufructuary rights were enjoyed by all community members for crop farming on *ghifar* (communal land) under *sheik's (*village leader) jurisdiction. Usufructuary right of use of trees was lineage based. All tree products were accessible to the lineage members to use for both home consumption and market regardless of on whose land trees were growing.

As for the techniques used in the extraction of the concerned NTFPs in the study area it was evident that there was a considerable variation in the ways by which these products were harvested, at the same time there were no advanced harvesting techniques as such for the various NTFPs in the study area, simple techniques and tools that involved no external inputs were used.

It was also evident that, the extraction activities of the NTFPs in the rural areas of Shiekan province were dominated by women, where about 91% of the respondents mentioned the woman as the one who used to collect these products, the children also found to participate considerably in this activity, where as men were rarely involved in it. At the same time it was found that women also used to sell, the products which they extracted by themselves and have the revenue from it.

The utilization of the NTFPs prevailing in the study area varied with the variation of the parts of the products, which were usually used by the households in these regions. For the majority of the NTFPs understudy the fruit was the main part that most of the respondents used. While the leaves of many of the products found to be used by a wide range of households, the other parts such as seeds, branches, flowers, stems, and roots were also mentioned to be used by the respondents in a lesser manner.

The main uses of most of the concerned NTFPs in these rural areas appeared to be confined mainly in food, drink, fuel and medicine, where as at the same time other considerable uses were referred to by the households such as forage, cosmetic and some home industries.

In the 27 surveyed villages in this region, nearly all the interviewed households (97%) gather and sell part of their extracted non-timber forest products. It could be said that, these families get revenue or some income from selling these forest products which for many (42.5%) enter into their living expenses. A significant part of local trade on NTFPs in the study area took place through bartering as well.

The markets of the NTFPs in the study area are widely dispersed and of ephemeral nature. And from the survey results one can predict the situation and patterns of marketing the NTFPs in this region, where the bulk of trade in NTFPs was local - being sold between households and traders, inside the village or other rural markets, where households usually sell the products they gathered to retailers in the village, trading intermediaries in the village (in their own villages or neighbor villages), in nearby trade towns or to wholesalers in Elobied town. These retailers and intermediaries in turn take these products to trade towns in the nearby or to Elobied or sometimes to *Soug Omdurman* in Khartoum province (which was known to be the largest market for NTFPs in Sudan). Some of the households used to collect the *Garad* product said that sometimes they sell the product directly to a tannery found in the region.

For the probability of participation of the surveyed households in collecting the NTFPs available in the rural areas of Shiekan province and the factors affecting this participation, (Worth mentioning that, factors affecting NTFPs-picking have not been examined before in Sudan, even outside Sudan these factors have been examined only separately and the method used in such studies has frequently been that of cross-tabulations. Studies that have made use of any kind of modeling approach have been rare).

Results obtained from the model of the binary logistic regression shows that, the probability values of 0.05 and lower indicate that the probability that a particular independent variable is associated with the decision to participate in collection is statistically significant. *Chi-square* statistics indicates whether the dependent variables collectively (I.e. the model) have a significant effect on the decision to collect.

All estimated models have high prediction power of classification (observations correctly classified) and the models have a good explanatory capacity (R^2) of more than 75%, except in the case of *Garad* which is 55%. The explanatory variables included in the models are jointly of high significance (0.00) as reflected by the Chi-squire statistic.

As for the effects of socioeconomic factors on participation of households in collection of NTFPs for different products (models), different factors are significant in the decision to collect. The size of the effect was measured by the odds ratio, which is an indicator of the change in the odds because of a unit change in the explanatory variable.

Collection of NTFPs was perceived by many respondents as facing certain constraints. The most frequently cited constraints are long distances to be traveled to get them and the pest and diseases affecting the products. Also the thorny nature of the trees was mentioned as a limiting factor as well as difficulty in collection (which might be related to thorny nature) and limited quantities of the products. Another group of constraints of less importance were said to be found.

The study shows that the main constraints facing the marketing of the NTFPs in the study area are the low prices of the products and lack of the transportation means.

Recommendations

The following set of recommendations are considered necessary by the researcher for the development of NWFPs in the study area and hoped that it would be considered by researchers, planners and policy makers in the future.

- More attention should be paid to NWFPs production in Sudan.
- Long-term sustainable resource management policies.
- Policy alternatives should be manipulated at the national level to support and encourage NWFPs producers to involve actively in the management of the NWFPs sources and other natural resources.
- At the policy and planning level food security should be incorporated as a specific objective in forestry strategies and programs.
- Adequate marketing facilities and pricing policy, which encourages producers of NWFPs to produce NWFPs and maintain tree cover should be adopted.
- Research is needed for identification and quantification of NWFPs production systems all over the country.
- Further research is needed to identify other factors that affect NWFPs production in the study area.
- In depth research on categories of beneficiaries and their social characteristics related to collection of NWFPs in the study area.

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CHAPTER ONE

INTRODUCTION

1.1 Background

Forests produce a great variety of goods and services for people. Thus, forests have value to people and contribute to meeting human needs in a number of ways. The contributions occur through either direct use of the forest; indirect use of the forest; the mere existence of the forest or of options for its future direct or indirect use (Gregersen *et.al*., 1995).

Over the past two decades, there has been an increased recognition of the many values of forests. This has led to new interests and efforts to develop a variety of goods and services as a means to achieve both development and conservation objectives (FAO, 2002).

Accordingly, forests were recognized as rich reservoirs of many valuable biological resources, not just timber. Non-wood forest products (NWFPs) emerged as an umbrella term to recognize the products derived from these various forest resources as a group (FAO, 1995a) which also includes Non-timber forest products (NTFPs).

These products are also called “Extractive”, “Secondary” and “Minor” forest products. And as indicated by CFAN (1992) they include all the non-industrial forest products that are harvested from trees, shrubs and other plants in the forest. This includes latex and resins, fruits and nuts, spices and oils as well as countless traditional and modern medicines.

The scope of NWFPs was proposed to be defined as all goods of biological origin other than wood, as well as services derived from forests and allied land uses (FAO, 1995b).

On the other hand NTFPs were defined as all biological materials other than timber that are extracted from forests for human use; this definition includes fuel wood (Gakou and Force, 1996).

Also NWFPs are an integral part of the livelihood of the 500 million people who live in or near tropical forests that cover 20 percent of the world’s land mass (CFAN, 1992).

Shepherd (1998) said that rural development is clearly about improving the life chances and well being of individuals and households, particularly the mass of rural poor who have been left behind in the process of economic growth. Rural incomes are very low in most poor countries so, as indicated by Kleinn et.als (1996) the promotion of NTFPs can and should complement the objectives of rural development and appropriate forest management, as they are sources of alternative employment and income generation.

It was also mentioned that, realization of the social values of forestry and its role in rural development revealed that minor forest products might be of more economic or social value than the wood itself (Shepherd, 1998).

In examining household use of NWFPs, it was found that these products were effective in both providing gathered **foods** that contribute to food self-sufficiency and hence food security, and saleable products that could supplement income needed to purchase food (Arnold, 1995). In supplementing household agricultural production, they are particularly important in reducing the shortages suffered during the "hunger periods" of the agricultural cycle. They help to even out seasonal fluctuations in availability of food and often contribute to essential inputs for household nutrition. They are also valued as components of social and cultural identity although these uses and values vary enormously from one area to the next (FAO, 1995a).

At the same time, traded NTFPs products contribute to the fulfillment of daily needs and provide employment as well as **income**, particularly for rural people and especially disadvantaged groups of women and therefore hold potential for rural poverty alleviation (FAO, 1996). Poor households and local communities in developing countries tend to be particularly dependant on NTFPs for subsistence and supplementary income and also enterprises based on NTFPs diversify opportunities for gainful employment and income generation (FAO, 1996). Poor households even where they are involved in market-oriented production on NTFPs, it is often undertaken as a part-time activity, they tend to receive low return and are vulnerable to competition and can not be always sustained (FAO, 1995b).

Environmental dimensions of NWFPs cover a wide range of roles and aspects. As was mentioned by Sharma (1995) in fragile ecosystems NWFPs activities hold prospects for integrated forms of development that yield higher rural incomes and conserve biodiversity while not competing with agriculture.

Generally, the non-destructive nature of NWFPs harvests supports sustainable management of forest resources and conservation of biodiversity. Their contributions to the socio-economic welfare of communities living in uplands and watershed areas and their amenability to integration with the management of protected areas and buffer zones and compatibility of management objectives, allow controlled extraction of NWFPs. Ecotourism, recreation and other services ,which are environmentally sound and safe, and which can generate income especially in marginal areas and for local populations provide intellectual property and heritage values as well as intrinsic values of several NWFPs to the communities and their cultural diversity. In addition, they provide linkage to forest biogeochemical cycles and food systems and their ability to incorporate both economic and ecological objectives (FAO, 1995a).

NWFPs are conceptualized by villagers as both concrete and intangible. The role and use of NWFPs can be subject to these cultural and mystic values that reflect people's history, religion, art and other aspects of its functioning as a society. Some of the products are sacred, while some products have spiritual or other cultural significance in many societies and have ceremonial roles, or make artifacts for ceremonial use or of special local values. Some certain foods are reserved for celebration of harvests and weddings. Also religious prohibitions or ethnic values may result in a number of systematic food avoidances (taboos) which discourage the eating of particular animals and plants (FAO, 1999).

1.2 Statement of the Problem

General: The world’s forests are being cut and burnt at such a rapid rate that if action is not taken soon, people risk undermining their vital function in maintaining a habitable planet. Already, forest loss is contributing to the extinction of plants and animals, increased flooding and disruption of climate patterns. In many parts of the world, forest decline adds to people’s social and economic distress. Particularly the natural forests in semi-arid Africa were disappearing at a rapid rate, because of the need for new agricultural land and, to some extent, also for fuel wood.

Sudan agricultural natural resources have deteriorated in the last decade due to drought and misuses; this had led to widespread poverty particularly in the hard hit rural areas. Several studies on poverty in Sudan have revealed that the ratio of the poor has risen over the last two decades to some 80 - 93 % (Abdel Ati, 1996). This poverty is the result of combination of structural, economic, social and environmental factors. Some groups have become marginalized during the process of national economic growth, further limiting their ability to participate in the processes of change as contributors and /or beneficiaries (Elmahdi, 1995).

The forests and woodland area in Sudan currently amounts to 85.90 million hectares comprising 34% of the total area of the country (FOSA 2000), which is continuously being encroached upon by expanding agriculture and urbanization or otherwise degraded by uncontrolled felling, overgrazing and floods resulting in serious environmental degradation and causing constant diminishing of the forestry resources (Omers, 1994).

Desertification is one of the most widespread serious problems facing the Sudan. Desert conditions have been moving southwards since 1960. The United Nations Sudano-Sahelian office report (UNSO, 1979) mentioned that within the Sudan, desertification was threatening 2.5 million feddans[1] of pump irrigation, 7 million feddans of mechanized crop farming, 75% of the world's gum arabic production, pasture for about 10 million head of livestock, and vast areas of woodland. Although the Sudan has a large area of plantations with significant areas of *Acacia senegal* (Hashab) and *Acacia nilotica*, it is one of the most deforested countries in Africa with an estimated rate of deforestation of one hectare annually (FNC, 2000).

Although the Sudan had forest legislation for a long time, forest management is not well established. A forest policy was issued with the objective of reserving 20 percent of the area of the country as forests under sustainable management at the end of the 1980s. At the beginning of the 1990s, only about 4 percent of the total forest area had been reserved under a presidential decree (FNC, 2001).

Afforestation and reforestation activities are restricted to areas constituted as reserves and subsequently put under management, almost exclusively owned by the Forest National Corporation (FNC). The afforestation inside forest reserves is 240 thousands hectares by 1999.

Regarding management, very little has been done with respect to management of these forests for sustained and improved yield. The only example of more intensive forest management of natural forests is the one practiced for the production of gum arabic, mainly from *Acacia senegal* in Sudan (Fries, 1992).

Sudan's long history of conflict has had significant impacts on its environment. Indirect impacts such as population displacement, lack of governance, conflict-related resource exploitation and underinvestment in sustainable development have been the most severe consequences to date. On the other hand, environmental issues have been

[1] (1 feddan = 1.038 acres or 0.42 hectares)

and continue to be contributing causes of conflict. Competition over oil and gas reserves, Nile waters and forests' products, as well as land use issues related to agricultural land are important causative factors in the instigation and perpetuation of conflict in Sudan. Confrontations over rangeland and rain-fed agricultural land in the drier parts of the country are a particularly striking manifestation of the connection between natural resource scarcity and violent conflict. In all cases, however, environmental factors are intertwined with a range of other social, political and economic issues.

As environmental degradation and resource scarcity are among the root causes of the conflicts in Sudan; practical measures to alleviate such problems should be considered vital tools for conflict prevention and peace building. Climate change adaptation measures and ecologically sustainable rural development are needed in conflicted areas to cope with changing environmental conditions and to avoid clashes over declining natural resources.

Competition for use of the world's forests is increasing and the public is more concerned about the fate of its forests. Given that there is more to be harvested from forests other than wood, the extraction of logs and timber is only part of the story of mankind’s use of the forests (CFAN, 1992). NTFPs activities hold potential for local livelihood improvement and maintenance of forest ecosystems, as well as economic growth (FAO, 1995b). People are looking for new products, uses and services from their wild lands so as to improve the economic status and well being of local populace-that is, to alleviate hunger, malnutrition, food insecurity, poverty and disease, prevent further degradation of their limited land base, and to maintain or increase forest (vegetation) cover (FAO, 1996).With this in mind and in light of what was mentioned by FAO (1978) that, for forestry to provide the maximum benefit to the community, it is important that people should be encouraged and assisted to make the widest possible use of the available products, and considering the many forest products, other than wood, which are in the forests and which may or may not be utilized by the local community, also people should be made aware of others which might be introduced if the environment is suitable and markets are available.

As the ecological balance in arid and semi-arid environment is delicate, sustainable land use practices are required if peoples’ basic needs for the future are to be fulfilled. Sustainable utilization of tree and shrub resources requires forest managers to become more broadly accountable for decisions regarding changes in such uses. Increasing the available knowledge about the broad range of values associated with forests provides decision makers with useful information for making choices among alternate uses of forest and land that meet the needs of the various groups involved (Gregersen *et.al*., 1995).

Although forest communities use NTFPs intensively as they have a great potential to raise income levels of rural communities and to contribute to sustainable forest management, not much emphasis has been put on NTFPs in the past, and NTFPs-related activities are poorly documented. Guidelines for sustainable use of NTFPs are non-existent and even difficult to establish. Further, technical and financial resources and market information are not easily available to rural communities (FAO, 2002).

Over recent years forestry activities have gained increased prominence. Major emphasis is now being placed on sustainable management of forests, i.e. the need to balance production of goods and services with conservation of the resource base. To reach this, there is a great need to reliable information on the environmental, social and financial value of forests. However, a lack or weakness of methodologies to provide realistic estimates of the worth of forests, and the benefits they can and do provide is a continuing constraint to sustainable forestry (FAO, 1995c).

Agenda 21 adopted by the United Nations Conference on Environment and Development (UNCED) held in Brazil in June 1992, has recognized the role of NWFPs in sustainable forest management and calls specifically for development of appropriate methodology to assess the value of forests in a comprehensive manner (Gregersen et .al, 1995). On the other hand NTFPs are attracting more and more attention from researchers worldwide. In many studies the importance of these products and their sustainable management is stressed, although their contribution to the subsistence of local populations and to the macro-economic development differs very much from region to region (Kleinn *et.al*., 1996).

Despite this existing information is still extremely scant regarding the status of the resource base, the probable impact of harvesting and collecting practices, etc., and area specific sustainable harvesting of NWFPs (Kleinn et.al, 1996). It is frequently emphasized that detailed and systematic data about the NWFPs natural resources is lacking (Kleinn et al., 1996). Also Sharma (1995) points out the lack of an ecological database. Specific constraints facing the contribution of NWFPs to sustainable rural development are: very little quantitative data available on production and values of NWFPs (and little reliable data on internationally traded NWFPs) ; lack of research and information on ecology of the species, management practices, harvestable level, sustainable harvesting practices, post-harvesting and processing technologies, market opportunities, quality requirements and control; market fluctuations, lack of clear and appropriate legislation and policy support (FAO,1999).

As NTFPs uses and activities in the subsistence and small enterprise sectors escape the attentions of statistical recording systems, quantitative information on their magnitude and structure is very sparse. Conventional analysis often fails to adequately capture many forest benefits that either do not enter the market or can not for other reasons valued in economic terms (Gregersen et. al., 1995).

Moreover, national institutions do not carry out regular monitoring of the resources or evaluation of the socioeconomic contribution of NWFPs as they do for timber and agricultural products. Consequently to date, non-wood forest products have not received the attention they deserve and have traditionally not been included in the economic accounts of most countries. This is in part due to a lack of knowledge on how to manage non-wood forest products; a lack of long-term sustainable resource management policies; and a lack of effective institutional frameworks to improve the management of these products. In addition, economic development efforts in most countries have not assigned a high priority to their improvement. Non-wood forest products have also been perceived as unprofitable, with low market visibility and characterized by a high degree of waste and inefficiency throughout the collection, processing, storage and marketing phases. Consequently, NWFPs are still largely neglected in the policy and decision making processes of natural resource management (CFAN, 1992).

Moreover, modern science and governments for so long overlooked the importance of this non-wood forest wealth and this might be due to three reasons as was reported by FAO (1995a);

First, most of these products are used mainly for rural subsistence or local markets. They often go unrecorded in official statistics, which focus on nationally traded goods (Chandrasekhar an, 1994).

Second, because modern government administration has divided these products among forestry, agriculture and horticulture, statistics do not recognize even nationally and internationally important non-wood forest commodities as originating from the forest. The divisions between, and the lack of clear definition of, agriculture and forestry have created a large blind spot in the way we reckon our dependence on forests.

Finally, modern forestry has favored timber and large scale enterprises, and has generally regarded non-wood forest products as incidental.

Through the experience of forest communities, forestry professionals have recently rediscovered the great importance of NWFPs (ranging from food, fruits and fibers, dye stuffs, flavors and medicines) for meeting people's needs (FAO,1995a).

As that forests, trees and woodlands, and the wild plants and animals they contained, were once the main source of food for many early hunter-gatherer societies. Over the millennia, it is the development of cultivated varieties of wheat, rice and the other staple crops, and the domestication of livestock, mans dependence on forests has declined. Nevertheless, there are a great many rural people who remain dependent on forests for critical portions of their food supplies (FAO, 1989).

The need for documentation and dissemination of fast disappearing local knowledge on the management and uses of NWFPs is urgently required (FAO, 1999). The available statistics on NWFPs still insufficient and in developing countries with low forest cover the available information base on NWFPs is even more limited (FAO, 1999).

NWFPs has provided income to rural people in Sudan since ancient times, yet, limited research has been done to identify the products, and far less is known about their role, management and marketing. Although there is an increasing recognition of the importance and wide use of NWFPs, still there is a lack of information about these products, areas of production, quantities, values, marketing, uses and producers (Suleiman and Eldoma, 1994).

In the Sudan research on NWFPs is limited. Socioeconomic research is even scarcer and is usually related to gum arabic (e.g. Sharawi, 1987 and Taha, 2000) and on some resins e.g. (Ishraga, 2003). Other studies provided data on production and consumption of NTFPs (FNC/FAO, 1995; El Amin and Ballal 1996; Mutwakil, 1998).

Also a research conducted in the Blue Nile State, southeastern Sudan, found that about 3 percent of the households in the state are involved in non-wood forest products gathering and marketing and all of these are contributing to the family income with varying degrees (Abnaouf, 2002). The same study reported that in most cases these non-wood forest products are consumed locally as food, medicine, fodder and in traditional industry and 30% of the women in this region gather these products for these purposes.

Another research carried out on the potential and extraction systems of NTFPs in Southern Kordofan State found that, the NTFPs in the study area contribute to both social and economic conditions of the people in the study area; the study also found that all inhabitants have free access to all types of produce in the natural unreserved forests (Hammad, 1998).

NWFPs despite their importance for local economies and for the people, they are still largely neglected in the policy and decision–making processes of natural resources management. There are many constraints facing the evaluation of the contribution of NWFPs to sustainable rural development (Study on forest valuation, 2003).

The study area, Shiekan Province, is known for its aridity and harsh conditions and low agricultural output and hence low income of its population. Saeed (1993) noted there is a serious discrepancy between income and expenditure and the prominent poverty of the rural population of Shiekan province. Forest products provide households with energy, material for traditional house construction, material for local furniture manufacturing, food, medicines and other traditional uses as well as income which serves as security for rural households buffering the effect of drought and crop failure (Mutwakil, 1998).

In spite of the fragile nature of the area, none or very little attention has been given to environmental degradation, deforestation or development of forest resources. Research attempting to asses the range of benefits and values of non-wood forests and trees products to the households and to the general environment in the area will be of great use to those who are concerned with the development of these areas. Socioeconomic studies, in particular will assist in understanding the relationships between people, economic factors, forests and ecosystems.

1.3 Scope and Aim of the Study

Livelihood has been interpreted and defined in many different ways (also as part of concepts like 'sustainable livelihood', 'livelihood strategies', 'livelihood systems' and 'livelihood approaches')**[**Cf. Chambers(1997:9-11), Scoones et al.(1996:3), Francis(2000:60) and Ellis(1998:1)**]**. These differences are not so much contradictory as they reflect a different focus, resulting from different objectives, questions and generations of research. Looking at various definitions, we can provisionally conclude that they all somehow refer to activities of people with regard to the management of means and opportunities that are basically directed towards the protection or improvement of material living conditions. This protection or improvement can be achieved by gaining direct access to income and assets, but may also aim at improving living and working conditions in such a way that a person or household become less vulnerable (Lont and Hospes, 2004). Some authors have explicitly reserved the livelihood approach for the study of the poor, whilst others leave open. Even so, most livelihood studies tend to be about poor people. One of the common and main starting points of livelihood studies today is that, if one wants to understand poverty and vulnerability, it is not enough to look at work and income alone (De Haan, 2000). One also needs to pay attention to all the other means and mechanisms through which people try to make ends meet. A livelihood study needs to look not only at cash income from work and other economic activities, but also at income in kind. Furthermore, it needs to pay attention to all kinds of cash and asset flows and finally, it needs to investigate the way in which the people deal with the resources they own or command. How do they save, invest and exchange? In other words, how do they try to balance their means and needs? Contemporary livelihood studies are based on this wider notion of means and mechanisms.

Different non-wood forest products (NWFPs) activities are linked as components of livelihood strategies that household employ, on the other hand the concept of food security recognizes that the nutritional well-being of people depends not just on food production; it crucially dependent on the reliability of production and on people's access to supplies. It thereby encompasses questions both of sustainability and equity. Given the above discussion it is obvious that, sustainable management of resources requires recognition of the socio-cultural elements of maintaining NTFPs and their resource base. This necessitates identification of particular cultural groups involved in related activities, identification of socioeconomic factors affecting this involvement, as well as assessing local traditional knowledge in dealing with NTFPs resources (FAO, 1999).

The **general objective** of this study is thus to investigate the contribution of NTFPs to the livelihood of households in rural areas. The study confines its focus to Shiekan province in North Kordofan State. The study covers all available NTFPs excluding gums and resins as these have been subject to relatively more intensive research. This knowledge is essential in laying the foundation for proper policy interventions to protect and develop NTFPs producing resources and contributing to reversing the trend of the environmental degradation.

Specifically the study aims at:

1. Identification of categories of beneficiaries and their social characteristics related to collection, use and marketing of NWFPs;
2. Exploration of the relationship between certain socioeconomic factors on the one hand and collection, use and marketing of NWFPs on the other hand. This includes exploring the gender dimension of NWFPs, perception of beneficiaries on benefits of NWFPs, types, quantities, sites and sources of collection of NWFPs as well as methods of harvest, treatment and utilization;
3. Identification of socioeconomic factors that influence the household decision to participate in the collection of NWFPs through estimating binary logistic models for each product or service.

CHAPTER TWO

LITERATURE REVIEW

For most of the recorded history, people have valued forests not for wood, but for other products. Ancient writings from China, Egypt and India recorded a wide variety of uses of forest plants, and compilations of botanical knowledge from Western Asia were prized by the ancient Greeks (Wickens, 1990).

Studies show that forests produce many more types of products than wood products particularly in some tropical forests (Toledo et al., 1992).

Whereas wood products have become major international commodities in modern times, NWFPs rank among the oldest traded commodities. Ancient Egyptians imported gum Arabic from Sudan for use in paints and the mummification process. International trade in sandalwood oil dates back to the twelfth century A. D. (Iqbal, 1993)

Where isolated forest communities exist in which wild plants and animals are still the major source of food. In India, for example some tribal groups depend almost entirely on hunting and gathering in forests and have little contact with the outside world. Similar communities exist in Papua New Guinea and in parts of Africa and Latin America. But while they are the most obvious examples, these are not the only people who rely on forest foods; for many millions of families living outside the forests, forest foods remain an essential supplement to their diet (FAO, 1989).

Several attempts have been made in recent years to catalogue forest food species (FAO, 1982; 1983a; 1983b; 1984; 1986a; 1986b). Although a large number of species have been identified with food uses, often very little is known about the quantities produced, the seasonality of production, or its variability from year to year. Thus, it is often difficult to assess their relative importance as food sources. Broadly, forest plant foods can be categorized as leaves, seeds and nuts, fruits, tubers and roots, fungi, gum and sap. Collectively they add diversity and flavoring as well as providing protein, energy, vitamins and essential minerals to the human diet. Some are collected and consumed raw while others require complex processing before they can be eaten (FAO, 1989).

Often forest foods are added to soups and sauces which accompany staple foods. They are often smoked, dried or fermented, and one of the common uses of these products is as snacks (FAO, 1989).

Forests, trees and woodlands also provide a habitat for many animals, birds, insects and other forms of wildlife that are hunted and consumed, often as delicacies. While these forest foods rarely provide staples, they do provide important supplements as well as seasonal and emergency substitutes when food supplies dwindle (FAO, 1989). Adding to that in mangrove areas, the forests are a habitat and breeding ground for many fish, crustacea and other marine animals that support coastal and off-shore fisheries (FAO, 1989).

Although the quantities of forest foods involved may be small, their nutritional contribution is often critical, especially at certain times of the year, and during droughts or other emergency periods when cultivated foods are unavailable (FAO, 1989). Some forest foods, are consumed throughout the year by rural households, but the most wide spread use of forest foods is in meeting seasonal food shortages either as nutrition gaps or hunger periods. These usually occur at the end of the dry season, they are also valued during peak periods of agricultural work, when less time is available for cooking (FAO, 1989). Forests and woodland areas, especially in Africa, have traditionally played a vital role during emergency periods, such as in drought, famine and war times (FAO, 1989; 1991).

The array of different foods consumed is vast; it ranges from beetle larvae to nuts and honey. For example, in the arid and semi- arid Sakhalin belt of Africa, as many as 800 different edible plant species have been identified (Becker, 1986). One group of agro-pastoralists, the Tswana, use 126 separate plant species and 100 animal species as food sources (Grivetti, 1976).

Malaisse (1985), cited wild leaves, either fresh or dried, are one of the most widely eaten forest foods. Typically they are used as a base in soups, stews, and relishes which traditionally accompany a carbohydrate staple. This combination is important because as well as providing nutrients these wild leafy vegetables add flavor to otherwise bland food, and encourage greater food consumption.

He added, leaves are an important part of traditional diets in many parts of Africa. In Upper Shaba, Zaire, for example, it was found that leaves from 50 different tree species were eaten.

In a study conducted by Ogle and Grivetti (1985) wild leaf vegetables are the most frequently consumed wild plants in Swaziland with 48 different species being commonly used. More than half the adults interviewed reported they ate wild leaves at least twice weekly when they were in season. While another study found that in Lesotho, Tanzania, wild leaves are eaten at nearly a third of all meals (Fleuret, 1979).

The nutritional value of leaves varies widely. Some of the most nutritious, such as the baobab, contain up to 13% protein. Others are good sources of vitamin A, vitamin C, calcium, niacin and iron. Although unusual, the leaves of some species also contain substantial quantities of fat, for example, *Bidens pilosa* (22.5%) and *Dracaena reflexa* (18%) (FAO, 1989).

Boiling fresh leaves in stews is the most common cooking method in several places. Some leaves, however, are dried and powdered. In parts of Senegal, powdered baobab leaves are eaten with couscous. In other cases leaves may be fermented as a means of preservation. *Cassia obtusifolia* leaves, for example, are fermented and used as a high-protein meat substitute, called ‘kawal’. The fermented leaves are made into a paste, or are dried and powdered. Kawal is used in stews and soups which accompany sorghum porridge (Dirar, 1984).

At the same time there are hundreds of species of wild fruits used worldwide. They are mostly eaten raw as snack food, although some, such as *Artocarpus communis* (breadfruit), are dietary staples (FAO, 1989).

Ogle and Grivetti (1985) noted that there were considerable variations in fruit abundance and consumption between ecological zones. There were also differences in the amount consumed by different family members; children generally ate the most.

Many of these fruits provide a useful source of minerals and vitamins, such as the fruits of *Zizyphus jujube (var. spinosa*) contain seventeen times as much Vitamin C per unit weight as oranges (FAO, 1989).

Seeds and nuts generally supply calories, oil and protein. From the point of view of nutrition, the most important nut- producing species are *coconut palm, oil palm and babassu palm*. In many parts of the Sahel, the seeds of *Parkia biglobosa* form an integral part of the diet (FAO, 1989).

Roots and tubers are other forest foods that provide carbohydrates and some minerals. They are used as drought and famine foods not only because they can survive under reduced precipitation, but also because they themselves can be an important source of water. They are also consumed as snacks by children, herders and others who rely on “bush foods” during the working day. Roots and tubers are also used as ingredients in traditional medicines (FAO, 1989).

Certain types of tree sap can be tapped and made into beverages, which are often high in sugars and minerals. Gums are also used as food supplements and can be good sources of energy. Both saps and gums have many medicinal uses. The gum of *Sterculia sp.* was found to be used as a dietary supplement by the Wolofs of northern Senegal. It is added to soups and stews, and is a good source of vitamins A and C (Becker, 1983).

Similarly, gum Arabic produced from *Acacia senegal* is traditionally an important food for pastoralists, agriculturists, and hunter-gatherers. Nomads from Mauritania use it to make N` dadzalla, a mixture of fried gum, butter, and sugar. It is also used as a milk substitute when mixed with sugared water, and is often the staple food for gum collectors in the field (Giffard, 1975).

Mushrooms are favorites in many cultures, and are often consumed as meat substitutes. They are also reported to be good sources of protein and minerals. In a study in Zaire, the average protein content of 30 types of edible mushrooms was found to be 22% of dry weight. In these regions the mushrooms are gathered by women and children during the rainy season and often marketed (Parent, 1977).

Forest wildlife is the second main category of food derived from the forests. For communities living in the vicinity of forests, natural woodlands and forest fallow areas, wild animals often play a significant part in local diets; in some cases they provide the single largest source of animal protein (Ajayi, 1979).

In terms of their contribution to the daily diet, the large game species such as antelope and deer are rarely the most important species. In many areas large game animals have become rare or inaccessible. Much more important are the smaller wildlife species, such as rodents and other small mammals, birds, various types of insects, snails, snakes and other reptiles, where we could find practices and local preferences vary greatly from place to place. The exceptionally high reliance on wild animals for food was recorded to be on bush meat consumption by the people in West Africa (Ajayi, 1979).

Food security has been defined by the committee on World Food Security as the "economic and physical access to food, of all people, at all times." It is fundamentally a social issue. The socio-economic links between forestry and food security are those that link the products and “services” of forests to the people who depend on them.

From the point of view of individual households, forests may affect their food security in several ways. Foods obtained from trees and forests make an important direct contribution to family diets. These food resources are established parts of the diet for huge numbers of people throughout the third world. They supplement the overall diversity and quality of diet, by providing a tasty and nutritious supplement to otherwise bland staple foods. They provide crucial vitamins, minerals, proteins, fat and oils and carbohydrates (Table 2.1).

Table 2.1: General contribution of forest foods to human nutrition

Type of forest food	Nutrient
Fruits and berries	Carbohydrates (fructose and soluble sugars), vitamins (especially C), minerals (calcium, magnesium, potassium); some provide protein, fat or starch.
Nuts	Oils and carbohydrates.
Young leaves, herbaceous plants	Vitamins (beta-carotene, C), calcium, iron.
Gums and saps	Proteins and minerals.
Invertebrates(insects, snails)	Protein, fat, vitamins.
Vertebrates(fish, birds, mammals)	Protein.

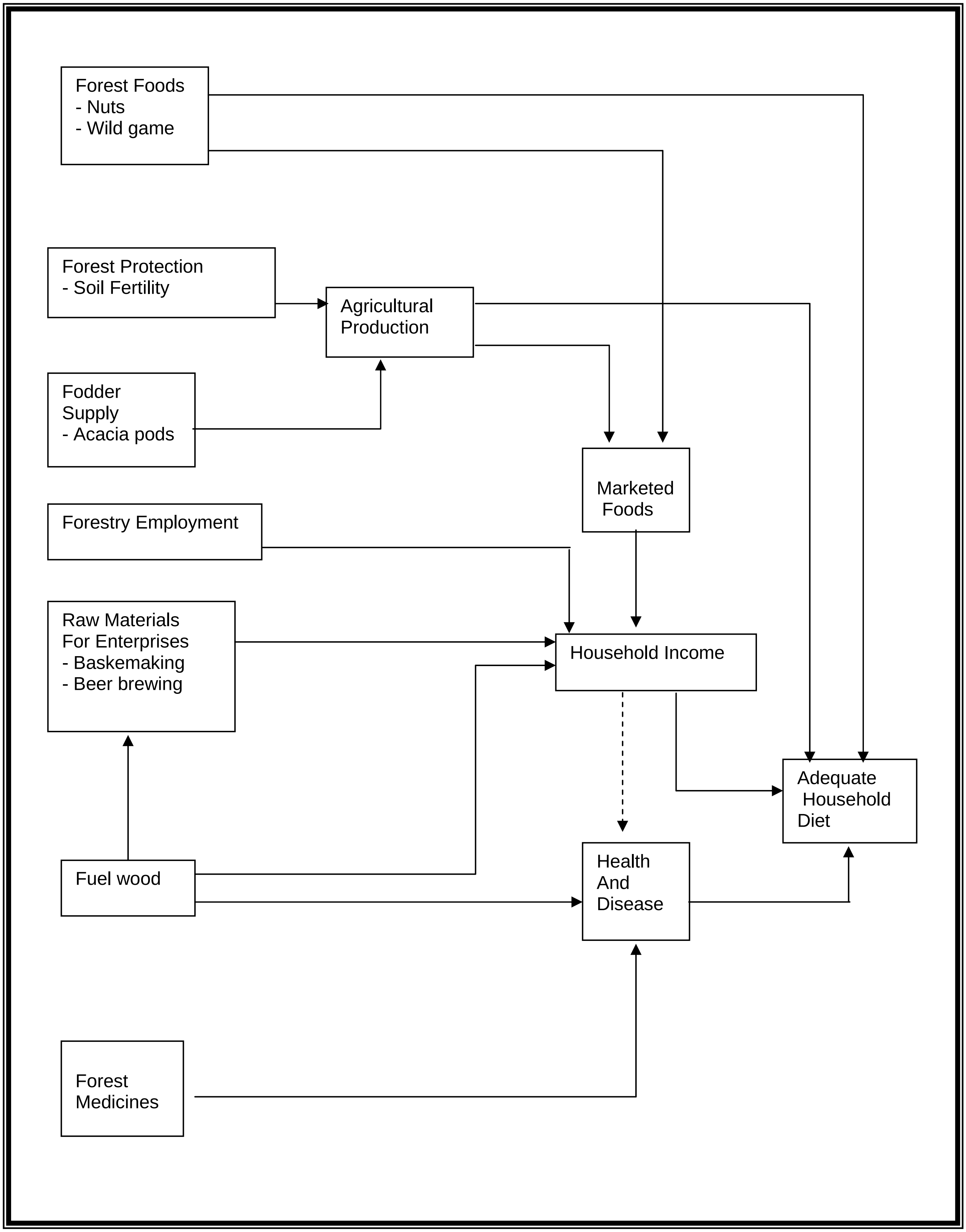
Source: Food and Nutrition Division, FAO 1994. (FAO, 1995c)

The concept of food security for rural households in developing countries encompasses all factors affecting a household's access to an adequate year round supply of food. It is concerned not just with the household's production of food crops, but with availability of income to purchase food where this is necessary (Arnold, 1995).

Figure 2.1 highlights some of the important links between forestry and food security and suggests some of the ways forest products and environmental benefits, as well as forestry activities, can have an impact on household food security and individual nutritional well being. The boxes on the far left represent forest products and benefits (e.g. shelter belts and fuel wood production). Moving to the right, the linkages between forestry outputs and household food status are illustrated (FAO, 1989 & FAO, 1991).

It is clear that many links between forestry and food security are inter-related. For simplification, however, these links can be divided into three main groups: environment, production, and socio-economic.

Figure2.1: The links between forestry and household food security



Source: Falconer 1989

In many rural areas forests and farm trees play an important role in household food security. Directly and indirectly many forestry activities have an impact on rural people's food situation (FAO, 1989 & FAO, 1991).

The food items produced by forests and trees represent a direct connection between forestry and food security. Fruits, nuts, leaves, roots and gums are just some of the huge array of edible foods that are obtained from trees and shrubs, either growing naturally in the wild or cultivated on farms and around homes (FAO, 1989).

Minnick (1991) also emphasizes the important role and considerable contribution of forests to environmental protection and in maintaining environmental stability.

Trees and forests influence both their immediate surroundings and the stability of the large environment, and as a result have several important links to food security. Both at the micro and the macro-level, they help provide the stable environmental conditions on which sustainable food production depends.

This was done by maintaining and improving soil fertility and by help sustains crop yields. The shade cast from trees is also important in the production of some crops and in animal husbandry (FAO, 1989 & FAO, 1991).

The effects of trees are most easily seen at the farm level, where they can play an important role in improving the micro-climate by moderating air and soil temperatures, increasing relative humidity and increasing the availability of soil moisture. The effect also could be seen in reducing the damage caused by wind, protecting against soil erosion, sand dunes movement, and restoring soil productivity (FAO, 1989 & FAO, 1991).

Where it is found that for many communities in tropical regions forests provide the only means for restoring soil productivity (through systems of forest fallowing).

The vegetative cover protects soils against wind erosion and intense seasonal rainfall. Furthermore, forests constitute an integral component of hydrological processes that help to maintain the levels of ground and service water (Minnick, 1991).

At the watershed level, forests and trees can reduce sedimentation and improve water quality; they may also have an effect on water availability downstream, and may assist to some extent in reducing the incidence of floods. All these factors have a major influence on downstream agriculture. At a regional and global level, forests may also affect climate and rainfall patterns – although the detailed interactions are controversial and still only partly understood (FAO, 1989 & FAO, 1991).

As Falconer (1990) said the effects of forests and trees extend further to support agriculture and livestock production in dry tropical areas. While forest fallows add to the long term fertility of agricultural soils, and in turns maintain the sustainability of the agricultural production systems. In many arid regions trees constitute an important source of dry season animal fodder.

IN pastoral production systems, trees and shrubs provide an essential source of livestock fodder**,** especially during the dry season. In communities who gain their livelihood from herding animals depends for their survival on an intimate knowledge of their environment. Because of their deeper root systems, production of browse from trees and shrubs is much more stable than that of grasses and herbs, with the fluctuations in rainfall between seasons (FAO, 1989).

Forest areas also represent the single largest storehouse of genetic diversity, a resource of great importance to future agricultural production (FAO, 1989). The species they contain-both known and yet to be discovered-may have a critical role to play in providing the genetic variation needed to combat the ever-adapting pests and diseases that prey on food crops, they may also provide a range of entirely new foods and medicines-of both plant and animal origin-that could have a major impact on human health and nutrition.

Conserving these genetic resources for future generations is being increasingly recognized as both a moral and practical imperative, although the problem is in devising ways of achieving this (FAO, 1991&FAO, 1989).

Falconer and Arnold (1991) mentioned that forests are important to rural people in developing countries as they provide the rural households and the community at large with the fuel and other essential goods and services. Fuel wood is the main energy source in most third world rural communities; all cooking and most food processing are dependent on fuel wood. As such, fuel wood supplies indirectly affect the stability and quality of food supplies, fuel wood supply even can influence the amount of food supplied or cooked.

The use of forest, woodland and tree products for medicinal and other health purposes is another aspect which is widespread; often in urban as well as rural households. More than 80 percent of the world's people depend on traditional medicinal plants for their health care. Furthermore, about 20 percent of the drugs in modern allopathic medicine are derived from plant sources (FAO, 1995a). Most plants used in traditional medicinal systems are still collected from wild sources.

Very large number of forest plants, and often some animal products, are frequently used within a single community. For example, 214 instances of medicinal use of plants were reported in a community in Sierra Leone (Davies and Richards, 1991), and 150 medicinal plants were observed in a location in Vanuatu (Olsson, 1991). Even in the relatively species- poor Sal forests of West Bengal, 47 species have been recorded as being used in 42 villages (Malhotra et al., 1993).

Medicinal usage tends to overlap with that of forest foods; particular items when added to foods serve both to improve palatability and act as a health tonic or prophylactic. There are also often strong links between NWFPs' medicinal use and cultural values; for example, where illnesses are thought to be due to the spirits, plants have acquired symbolic importance as treatments (Arnold, 1995). However the striking feature emerging from contemporary studies is the high level of continuing use of traditional medicines in most situations.

Further more, forests and trees have their vital effects that can be indicated in the structure and function of the traditional, social and cultural systems in the tropics (Minnick, 1991). It is worth mentioning that forests and forest products provide an important source of income and employment opportunities for the rural communities.

Even more important for many families is the fact that forests provide a source of income and employment. Millions of rural people depend on money earned from gathering, processing and selling forest products to buy food and other basic necessities. Trees grown on the farm are also used as savings, which can be harvested and sold to meet large or emergency cash needs (FAO, 1989).

In some areas, collection and processing of forest products has taken over as the main income generating activity. In one study in Sierra Leone, 18.6% of farmers interviewed said that they considered; non-agricultural enterprises- which included processing activities, fuel wood collection, hunting, fishing, palm wine tapping and handicrafts to be; more important than farming (Engel et.al, 1985).

Small scale forest- based enterprises in Zimbabwe, which mostly are based on NWFPs, employed 237,000 people in 1991, compared to 16,000 employed in conventional forestry and forest industries for the same year (Arnold et al., 1994).

One of the advantages of small-scale forest-based enterprises is the benefits accrue directly to the household concerned. For many families, a significant percentage of their income is generated through forest based activities. In north-east Brazil, for example, an average of 25% of household income (including non-cash income) comes from babassu palm kernel gathering and processing during the dry season (May et.al, 1985).

Income earned from forest-based activities is some times invested in agricultural assets such as livestock or land. In this sense these forest resources offer the poor a means for investment in their future thus providing an opportunity to escape the cycle of poverty.

For most of the worlds' rural households, NWFPs provide essential food and nutrition, medicine, fodder, fuel, thatch and construction materials, mulch and non-farm income. These products are particularly important in relieving the 'hunger periods' in the agricultural cycle, and in smoothing out other seasonal fluctuations. Dealing in NWFPs can provide employment during slack periods of the agricultural cycle, and provide a buffer against risk and household emergencies (FAO, 1995a).

Poor households, in particular, depend on these products for their livelihood because they usually have more access to the forest than to other resources. For the same reason-greater dependence on open-access forests, for lack of other options-women usually rely more than men on NWFPs for household use and income (FAO, 1995a).

Moreover for the poor, and also for women, these are often one of their only sources of cash income (FAO, 1989).

In many places, women are responsible for the household activities that involve forest-based foods and medicines, as well as fuel wood. In this respect NWFPs are particularly important to women, addressing their needs for food security and nutrition (FAO, 1995a).

While it is sometime assumed that women are mainly involved in subsistence activities, in fact they are extensively involved in many forest-based gathering and processing enterprises. Women often have little access to land and capital resources. Thus, forests provide a source of raw materials and products for cash sale. In addition, women often combine cash earning activities with forest based subsistence activities such as food and medicine collection. Many forest-based activities can be undertaken near the homestead, thus allowing women to combine these activities with domestic chores (Arnold, 1995).

Women figure prominently as owners as well as employees in forest-based enterprises in some countries (Arnold et.al., 1994).

It is estimated that women constitute 51% of the total workforce involved in forest-based small scale enterprises in India, amounting to over 518 million days annually.

Ninety percent of the forest- based employment for women is generated in forest-based small scale enterprises. This is in direct contrast to their involvement in purely wood-based large scale forest industries, in which women constitute around 10% of the workforce (FAO, 1991).

FAO (1987) cited that, in Jamaica, for example, 32% of the enterprises are owned by women, and women make up 30% of the labor force. It also mentioned that there is a clear distinction between the types of enterprises involving women and men. In Zambia, it was found that women owned a large share of the enterprises involved in broom making; but they are rarely involved in carpentry or furniture making.

The fuel wood trade is often dominated by women. In Sierra Leone, 80 percent of the urban firewood sellers are women (Kamara, 1986). In a survey of women fuelwood collectors in Gujarat, India, it was found that 70% of women collected fuelwood for sale for more than 25 days of the year (few collected wood during the monsoon season). Most of the income derived was used for buying food (Buch and Bhatt, 1980).

Women also play an important role in the collection and processing of Babassu palm fruit in Brazil. While both men and women gather the fruit from the wild, it is the women who process the fruit and kernel oil (May et.al, 1985). Similarly, in Sierra Leone, women are responsible for processing oil palm kernels which are gathered from the wild by both men and women. Much of the income generated from the sale of palm oil goes to men; women, however, retain some of the kernels to earn money for themselves.

From the point of view of family nutrition, women's income is often particularly important. Some studies have compared women's and men's spending patterns and have found that women tend to spend more money on basic food supply. Nutritional status is therefore more directly dependent on women's income than men's (FAO, 1989).

While forest-based activities provide numerous opportunities for the rural poor, the earnings vary substantially from one activity to another. The returns to labor from many forest-based activities are marginal. In addition, markets for products may be quite vulnerable to introduced substitutes.

Thus, while forest activities provide some means of income earning for a large number of rural poor, activities which are dominated by the poor and women often provide the lowest returns. Therefore, these enterprises may not be sustainable in the sense that they will be abandoned if other income earning possibilities arise or if substitutes cause a market collapse (Falconer and Arnold, 1991).

In local, urban, national and international markets, forests foods and medicines contribute substantially to national economic growth. NWFPs are therefore important to three main groups (FAO, 1995a):

- Rural populations (the largest group) who have traditionally used these items for livelihood and social and cultural purposes ;
- Urban consumers (a smaller group, but growing faster), who purchase these items;
- Traders, and product processors, whose numbers in the NWFPs sector increase as urban markets for these products grow.

A market is created whenever potential sellers of a good or service are brought into contact with potential buyers, and a means of exchange is available. In sustainable forestry the role of marketing is to help create better linkages among resource management, processing, and the end use. Marketing can reinforce sustainable forest management by indicating the kind of products and raw materials required, and by providing incentives through income distribution (FAO, 1995b).

Trading activities are often conducted seasonally, when demand for agricultural (or other) labor is low. Especially the rural poor rely on income from NWFPs in these periods when returns from other sources decrease (Raintree and Francisco, 1994).

The process of exchange takes place in village markets between the gatherers/producers and final consumers (Raintree and Francisco, 1994).

Most of the products traded are consumer goods; they are not processed further by any industrial activity. NWFPs traded locally include fodder, food items, plant animal based medicines, construction materials and furniture (Raintree and Francisco, 1994). Quantification of the local trade is extremely difficult due to its sporadic nature and because only a part of it is monetary-based (Raintree and Francisco, 1994).

Information on NWFPs trade is scarce and dispersed. The nature/type, size, spatial spread and scope of NWFPs markets were varying. Based on their special characteristics, local, urban, national, regional and international markets could be distinguished. The information for some internationally traded products is more readily available than for others of more local importance (Lintu, 1995).

Lintu (1995) also said because of the variation of NWFPs, ranging from fruits and nuts to aroma chemicals and phytopharmaceuticals, they were found to be use in a wide range of markets at the local, national and international levels, as well as for bartering in subsistence economy.

Local NWFPs markets although often “invisible” in accounting records, are vitally important to local communities. A large number of vendors are involved locally in selling NWFPs. Many of them sell products collected by them for making extra income; others are supported by a network of merchants and several levels of buyers. Fruits, leaves, bags, baskets and other handicrafts, thatch and other building materials; charcoal and fuelwood; medicinal plants and fish tend to feature heavily at this level (Lintu, 1995).

Middlemen and local traders often buy the products cheaply from widely dispersed producers and sell them in the markets outside the locality or supply the products as inputs to processing units (FAO, 1995b).

Middlemen who control access to the market often exploit the collectors of NWFPs, or by those who control access to the resource. Thus the NWFPs collectors have no adequate incentive for practicing properly controlled and sustainable harvesting. Cultivators, collectors and resource owners of NWFPs do not get a fair share of the real value or value added (FAO, 1995b).

NWFPs are an important source of foreign exchange for many countries. A recent FAO study identified 116 items of NWFPs as commercially important in international trade, considering the group of medicinal plants as one item. Available information suggests that 500 to 600 different medicinal plants enter international trade (FAO, 1995a).

Through the developing world forest resources are rapidly being degraded, logged, cleared for agriculture and cordoned off (either privately or by governments). In many regions, the result is that an ever-expanding rural population must rely on decreasing forest and land resources. In terms of household food security, this trend implies diminishing availability and use of forest food resources as well as diminishing knowledge about their utility, fewer incomes earning opportunities for the rural poor and increased burdens on households in their efforts to meet their basic needs. Rural people, especially the poor, employ a diversity of means to help meet basic needs: food crop production; forest product gathering, consumption, processing and sale; cash crop production and income earning enterprises both on and off the farm. The impact of changes in the physical, social and economic environments will affect people in different ways, depending on their available resources and opportunities (Falconer and Arnold, 1991).

Most of the products are extracted from natural stands in various type of forest and woodland ecosystems. However, among the current issues of global resource monitoring is the lack of management of non-wood resources. For products in high demand, this often leads to unsustainable harvest levels and the potential endangerment or extinction of the species; this has serious socio-economic implications for people dependent on the availability of these resources. Some important products, such as bamboo, are evolving into farmed crops, while others, such as many medicinal plants, are becoming endangered because of deforestation and / or over harvesting. The use of synthetic substitutes has made many others, obsolete.

Non-wood forest products (NWFPs) offer scope for innovative variations on the standard repertoire of forestry, agriculture and forest industry practice. They can make integrated approaches to land use still more versatile. They can make sustainable forestry practices easier to promote by enhancing the value and fringe benefits of standing forests, so deflecting local pressures to over harvest the timber component (FAO, 1993).

The most commonly cited instances come from Latin America, where the term *extractive reserves* describes a system where forest is set aside for low-impact use by traditional communities in the area. However, no single model can suit all conditions (FAO, 1995a).

NWFPs, by complementing wood-based management, offer a basis for managing forests in a more sustainable way. In fragile ecosystems, NWFP activities hold prospects for integrated forms of development that yield higher rural incomes and conserve biodiversity while not competing with agriculture (Sharma, 1995). An important concept in realizing these prospects is adding value locally, usually through some form of rural processing, to ensure that a fair portion of a product's market value accrues to the people who manage the forest resource.

In recent years also, a growing body of scientific research has suggested that, given certain basic conditions, NWFPs can help communities to meet their needs without destroying the forest resource (FAO, 1995a).

Agenda 21, approved by the UN Conference on Environment and Development (1992) which provides a global plan for action, has recognized the role of NWFPs in sustainable forest management. UNCED (1992) highlighted the importance, already recognized by many governments, of informed participation by local communities in all aspects of forest management and planning. Involving communities in managing local resources is therefore not simply an equity issue; it is an issue of wise resource use. Failure to do so has broad consequences. Witness the case of Australia, which although home to more than 20.000 species of native flora, until quite recently produced no new food crop except macadamia nuts (*Macadamia species*), which were domesticated elsewhere. This singular failure is probably because European settlers refused to accept that the indigenous people knew any plants worth cultivating (Wickens, 1990).

Many people assume that harvests of NWFPs have less impact on a forest than logging. However, this assumption is unfounded. Forest ecosystems have such complex interrelationships that harvests of some non-wood resources can affect plant (and wildlife) populations as negatively as logging. Without a sound knowledge of the resource and regular monitoring, harvests of certain non-wood resources can have a disastrous impact that is not noticed until it is too late to remedy. For example, over harvesting of fruits or seeds of a tree species can drastically reduce regeneration to the point of local extinction without any visible effect, large individual trees may remain and the system might appear undisturbed. Only years or decades later, when the large trees die and no individuals replace them will the damage become evident (Peters, 1994).

Since volume involved for individual NWFP is in most cases small, attention devoted to their harvesting also tends to be less. The collectors are mostly unskilled and untrained in scientific methods. As a result the harvesting standard of many NWFPs are poor and rudimentary, and hence wasteful, destructive and unsustainable. Efforts are also not made, usually, to harmonize harvest of wood and non-wood products (Reis, 1995).

It is important to recognize that it is not a choice of either timber or non-wood products traditional management systems of forest, peoples and modern scientific experience with multiple use management suggest that, with careful planning and monitoring, forests can yield both timber and non-wood harvests on a sustainable basis (FAO, 1995a).

Forests offer a variety of production activities for improving local incomes that do not jeopardize the forest ecosystem. Forest management for NWFPs can provide a continuing source of livelihood and help to maintain the forest resource for future generations. The focus therefore should be on activities that produce items for subsistence and market use and also considers several activities, such as ecotourism (environmentally and culturally sound tourism based on local scenic attractions) and environmental data gathering (also called “biodiversity prospecting”) which involve no harvest, just observation (FAO, 1995a).

Thus the importance of forests for meeting environmental, developmental and social goals is fully recognized. Yet there is feeling that commitment to sustainable forest management could be more effective if the full value of forests could be demonstrated (FAO, 1997). Inadequate recognition and underestimation of the values of the many goods and services provided by forests at local, regional, national and global level has been assumed to be one of the major causes of failure of sustainable forest management.

The need to properly value the goods and services of forests, forest lands and woodlands has long been recognized. Proper valuation of forest goods and services is dependent on reliable information on the forest resource, both quantitative and qualitative information including physical as well as socio-economic elements. In this sense environmental and social impact assessments are closely related to the valuation of forests even if they are distinct in nature (FAO, 1997).

Valuation should be a neutral analytical tool, not an advocacy instrument, as it is just a tool that can increase the knowledge of the range of monetary values associated with forests. As such proper valuation of forest resources can provide useful information to all those associated with choices among management options and alternative uses of the forests and lands to meet the needs of the group involved (FAO, 1997).

As mentioned by Brown (1984), value is the worth of a product or service to an individual or a like-minded group in a given context. Here valuation is understood in its economic sense, i.e. monetary values.

Economic value associated with forests can be shown by the breakdown of values developed in box 2.1 by Gregersen et.al. (1995).

Box 2.1 Classification of forest values

1. Use Values

A. Direct use values (*associated with the following benefits*)

A.1 Consumptive uses

A.1.1 commercial/ industrial market good (fuelwood, timber, pulpwood, poles, fruits, animals, fodder, medicines, commercial non-wood products (e.g. rattan) etc.).

A.1.2 indigenous non – market goods and services (fuelwood, non - commercial non-wood products, animals, skins, poles, fruits, nuts, medicinal plants etc.) food security.

A.2 Non – consumptive uses

A.2.1 recreation (jungle cruises, wildlife photography, trekking, etc.)

A.2.2 science/education (forest studies of various kinds).

B. Indirect use values (*associated with the following benefits*)

B. 1 Watershed protection.

B. 2 Soil protection, nutrient recycling and soil fertility, agricultural productivity enhancement.

B. 3 Gas (e.g. carbon dioxide/oxygen) exchange, contribution to climate stabilization and carbon storage.

B.4 Habitat and protection of biodiversity and species.

B. 5 Aesthetic, cultural and spiritual values.

11. Non – Use Values

C. Option values

C.1 People may value the option to use a forest in the future. Although such values are difficult to measure in economic terms, they should be recognized in value in the contributions of forests to human welfare. This concern can contribute to conservation and preservation of forests.

D. Existence and bequest values

D.1 People may value a forest or resource complex purely for its existence And without any intention to directly use the resource in the future. This Includes intrinsic value.

D.2 People may value a forest as a bequest to their successors or others.

Source: Adapted from Gregersen et.al. (1995).

To measure these values the following main methods were usually used:

1- Direct market prices which are used to value all market goods and services from the forest, unless there are market distortions, in such case the following methods are used:

2- Indirect market prices (value inferred from other market prices), e.g. residual values, value of production increases, surrogate prices and replacement cost or cost avoided, opportunity cost, hedonic price and travel cost,

3- Non-market price valuation methods such as willingness to pay for a given event or activity (Gregersen, 1996).

Over recent decades recreation has become an important product of forests in affluent nations, and is becoming increasingly important in other countries as well. The two main stands relevant to forestry are tourist income generation and evaluation of consumer surplus from informal recreation (Price, 1989).

Scraper et.al. (2000), attempted to estimate benefits from forest recreation using flexible functional forms for willingness to pay distributions.

In Sudan Sharawi (2002) attempted to value the recreational service provided by the Khartoum Sunt Forest by applying individual travel cost method.

Tenure clarification is a major point that should be evolved to provide every one with an access to livelihood. Controls exercised by forest services are paralleled by other changes that restrict or remove users' access and rights to harvest as pressures on a resource increase (Arnold, 1995).

In agrarian societies the land tenure systems include complex rules concerning cultivation, rights to hunting, gathering, grazing, fuelwood collection, right of transit as well as rules concerning inheritance, transfer and the admission of outsiders. Barraclough and Ghimire (1995) defined the land tenure systems as the rules that regulate agricultural production and rural life more generally.

Ogendo (1990) identified four types of ownership for wooded areas in the tropics:

a) Forest reserves where grazing right is usually allowed while cultivation is not. Individuals from the villages within the area are entitled to collect dead wood and fallen branches, but cutting of live wood and manufacturing charcoal is restricted to licensed specialists,

b) Communal forest areas which are subject to unregulated exploitation,

c) Village controlled forest areas which are closely supervised by villagers. Wood collection and grazing is limited to village members,

d) Privately owned woodlots, are those planted in fallow fields, and trees belong to the title holder.

Arnold (1995) noted that in most developing countries use of trees on common land was progressively monopolized by the rich and powerful as market demand for forest products grew, forcing the poor to collect their needs from distant fields. However when people have relatively unrestricted access to forests, the income from forest products is often of particular importance for poor groups within the community.

Property rights are also divided by FAO (1997) into four categories:

- Private property situations are fairly straightforward, although resolving conflicting land-use claims can be complex.
- Common property resources have clearly recognized users who, although they may not own the resource, have recognized access rights and the ability to limit access to other (ATI, 1995). Many traditional communal systems for land use are common property systems.
- Open-access resources, accessible to all, have no recognized users and are not easily controlled.
- State or public property often requires users to negotiate rights or obtain authorization for secure rights or access.

Successful extractive activities using NWFPs often have the features of common property management. Common property resources may often be mistaken for open-access resources, but common property resources are more widespread (ATI, 1995).

The past decade has witnessed greatly increased interest and activities concerning NWFPs, especially with regard to their social and economic role. In this aspect a study conducted by FAO/FRA (2000) in order to evaluate the socio-economic importance of NWFPs utilization world wide currently, this study concluded that, data collection for this study confirmed that there is a serious lack of quantitative data at the national level on non-wood forest products (NWFPs) and even less on the resources that provide them, with the exception of Asia where there is a tradition of national collection of information on NWFPs resources and consumption.

Information is scarce and often mixed with agricultural production statistics. Statistical data, where they exist at all, are mostly limited to selected internationally traded products and, in this case, data are usually limited to export quantities.

Information on the resource base and on subsistence use of NWFPs is non-existent, mainly because of the multitude of products used by local people and the technical difficulty and high cost of measuring and reporting on them.

Even when data exist, they are seldom based on recurrent, statistically designed surveys and inventories, and it is therefore difficult to assess the reliability of the information. For example, even in Asia much of the information is based on national inventories up to ten years out of date. A similar problem exists for the economic value associated with the products because value can be calculated at different stages of production and processing.

The data obtained from traditional forestry institutions responsible for the forest resources often differ from the trade data reported by customs agencies.

National level data on the resources and on production and trade (quantities and values) of major products are essential to assess the full contribution of the forest sector to the economy of the country, and for forest management and policy development. In some cases NWFPs resource and product information is available on a national basis, but in most cases, the information is available only for parts of the country. Therefore, extrapolation is necessary but difficult.

Because of the factors described above, as well as the lack of internationally agreed-upon terminology, concepts and clear definitions, statistical data on NWFPs resources and production are not usually comparable among or even within countries or regions. Therefore, regional and global aggregation of production and value is very difficult. A classification system with unified terminology and measurements is needed.

According to this study FAO/FRA (2000) the most important NWFPs for the different African sub regions, i.e. north, west, central, east, insular east and southern Africa, are medicinal plants, edible products (mainly edible plants, mushrooms, bushmeat and bee products) and fodder (table 2.2). products of relevance for specific sub regions are exudates (east and west Africa), cork and aromatic plants (north Africa), ornamental plants and living animals (insular east Africa) and rattan (central Africa).

NWFPs are collected in all kinds of habitats, whether in closed or open forests, woodlands (e.g. miombo woodlands in east and southern Africa) or shrub lands (mainly in arid zones). Many products (e.g. shea butter) are derived from trees outside the forest located in agricultural fields, fallow areas or home gardens. Plantations have been established for species providing high-value products mainly traded on the world market, such as *Acacia senegal* or *Cinchona spp*.

Medicinal plants are of major importance for all African regions, both for their use in traditional medicine and for trade. In Africa, a large percentage of the population depends on medicinal plants for health care. The number of species used is not known; in Ethiopia, for example, 600 plant species are documented as being used in traditional medicine. This important role is underlined by the high ratio of traditional healers to western-trained medical doctors, estimated to be 92:1 in Ghana (Kwahu district) and 149:1 in Nigeria (Benin City).

Medicinal plants used in traditional medicine are either collected directly by the user or sold in local markets. In addition, medicinal plants are traded on the world market.

The most important African countries exporting medicinal plants (including plants from cultivated sources) are Egypt and morocco. important internationally traded species include *Thymus spp*., *Laurus nobilis*, *Rosmarinus officinalis* (north Africa), *Prunus africana* (east, southern and central Africa), *Warburgia salutaris* (east and southern Africa) and *Harpagophytum procumbens* and *Harpagophytum zeyheri* (southern Africa).

NWFPs provide important foodstuffs, in particular during the "hungry season" and in marginalized areas. Important edible plants include fruits (e.g. *Riving gabonese*, *Elaeis guineensis*), nuts (e.g. *Vitellaria paradoxa),* seeds (e.g. *Cola acuminata*), vegetables (*Gnetum africanum*), bark (e.g. *Garcinia spp*.) roots (e.g. *Dioscorea spp*.) and spices (e.g. *Piper guineense*). Mushrooms such as *Cantharellus spp*. and *Boletus spp*. are mainly collected in east and southern Africa. Bushmeat is an important edible product, in particular in the humid parts of central and West Africa. Species hunted include antelopes, gazelles, monkeys, wild boar and porcupines. Honey and beeswax are of major importance in east and southern Africa. Ethiopia, one of the major producing countries in Africa, exported 3000 tonnes of honey and 270 tonnes of beeswax annually between 1984 and 1994.

Table 2.2: Main NWFPs of Africa

Sub region	Main NWFPs	selected national statistical data available	Reference
North Africa	Cork, medicinal plants, aromatic plants, fodder	Algeria: annual cork (quercus suber) production of 6000tonnes exploited from 460 000 ha of cork forests. Morocco: annual export of 6 850 tonnes of medicinal plants worth us$12.85 million in 1992 – 1995 Egypt : annual export of 11250 tonnes of medicinal plants worth us$12.35 million in 1992 –1995 Tunisia: annual production of 10 000 tonnes of *Pinus halepensis* seeds	NCQC 2000 Lango & Miadenova 1997 Lango & Miadenova 1997 El Adab 1993
East Africa	Exudates, medicinal plants, bee products	Eritrea: export of 49 tonnes of gum arabic (*Acacia senegal*) and 543 tonnes of olibanum (*Boswellia papyrifera*) in 1997. Ethiopia: annual honey production of 20 000 tonnes in 1976 – 1983 and annual production of gum arabic of 375 tonnes in 1988 – 1994 Tanzania: export of 756 tonnes of *Cinchona sp*. bark, worth US$258 000 in 1991	Eritrea ministry of agriculture 1998 FAO 1998b Chihongo 1992
Insular East Africa	Edible plants, medicinal plants, ornamental plants, living animals	Madagascar : export of 300 tonnes of *Prunus Africana* bark worth US$1.4 million in 1993	Walter 1996
Southern Africa	Edible plants medicinal plants bee products, fodder	Namibia : annual export of 600 tonnes of *Harpagophytum spp*. worth us$1.5-2million in 1998 Zambia :honey production of 90 tonnes and beeswax production of 29 tonnes worth us$170 000 and us$74 000, respectively, in 1992	FAO 1998a Zambia MENR 1997;Njovu 1993
Central Africa	Edible plants, medicinal plants, bushmeat, rattan	Cameroon: annual export of 600 tonnes of *Gnetum spp*. leaves worth us$ 2.9million Rwanda: production of 23 000 tonnes of honey in 1998	Shiembo 1999 FAO1999a
West Africa	Edible plants, medicinal plants, bushmeat, fodder	Burkina Faso: annual export of 14 200 tonnes of shea butter (*Vitellaria paradoxa*) worth us$2.4 million in 1984 – 1990 guinea: annual use of more than 100 million chewing sticks (*Lophira lanceolata*) Liberia: annual use of 100000 tonnes of bushmeat for subsistence purposes	Zida & Kolongo 1991 Camara 1991 FAO 1997b

Table 2.3:-Production and Exports of Gum Arabic in Africa

Country	Year	Annual production tonnes	Annual export tonnes	Reference
Chad	1997 / 98	Not available	10 000 – 15 000	FAO 1999 b
Eritrea	1997	Not available	49	Eritrea ministry of agriculture 1998
Ethiopia	1988-94	250-300 (*Acacia senegal*)	Not available	Chikamai 1997
		50-100 (*Acacia seyal*)	Not available	Chikamai 1997
Ghana	1988-94	< 10	Not available	Chikamai 1997
Kenya	1988-94	200-500	Not available	Chikamai 1997ghana
Mali	1989	293	Not available	Fao 1991
Niger	1970	Not available	300	Niger ministere de I'hydraulique et de I"environnement 1998
Nigeria	Not available	4 000-10 000 tonnes	Not available	Nour 1995
Senegal	1990	Not available	500-800	Senegal mdrh 1993
Sudan	1994	22 735 (*Acacia senegal)*	18 339 *Acacia senegal)*	FAO 1995b
	1994	11 049 (*Acacia seyal*)	4 396 (*Acacia seyal)*	FAO1995b
Tanzania	1994	1 000	500	Makonda & Ishengoma 1997

Fodder is of great importance in the arid and semi-arid zones. Fodder is mainly provided from tree leaves, shrubs and bushes such as *Acacia tortilis* (Zimbabwe), *Khaya senegalensis*, *Faidherbia albida* and *Balanites aegyptiaca* (all West Africa). Forage plays an essential role in animal-based production systems; in the Niger, for example, tree forage contributes 25 percent of the fodder supply for ruminants during the dry season.

Exudates are another group of products of major importance for Sub-Saharan Africa. Important products include gum arabic (*Acacia senegal, Acacia seyal*) (Table 2.3) as well as resins such as olibanum (*Boswellia papyrifera*), myrrh (*Commiphora myrrha*) and opopanax (*Commiphora spp*.). These products are mainly provided by three East African countries, the Sudan (gum arabic, olibanum), Ethiopia (olibanum) and Somalia (myrrh, opopanax).

In insular East Africa, ornamental plants and living animals are of major importance. Major ornamental plants are *Trochetia boutoniana* in Mauritius and *Cyathea* sp. (fern tree), *Ficus* sp., various orchids and aquatic plants in Madagascar. In 1993, 300 000 individual plants of the aquatic plant *Aponogeton* sp., worth US$70 000, were exported from Madagascar. The most valuable Malagasy animals in trade are reptiles and amphibians (e.g *Mantella aurantiaca*); their annual export value reached US$ 700 000 in 1990-1995.

Cork and aromatic plants are important in North Africa. Thirty- three percent of the world's cork forests (*Quercus suber*) are located in North Africa, i.e. Algeria, Morocco and Tunisia. However, this region only contributes 9 percent (30 000 tonnes) of the world cork production of 350 000 tonnes. In particular, Algeria has low cork production (2 percent of world production) in spite of its extensive resource, making up some 21 percent of the world's cork forests.

Aromatic plants such as *Thymus sp*., *Rosmarinus officinalis*, *Acacia farnesiana* and *Eucalyptus* spp. are important products of Egypt, Morocco and Tunisia. In Tunisia, for example, the export of essential oils reached 230 tonnes worth US$3.2million in 1996.

Depletion of habitat and/or overexploitation is the main threats to the resources providing NWFPs.

Overexploitation has been documented for species such as *Acacia farnesiana, Cyathea spp, Cycas thouarsii, Gnetum africanum*, *Podocarpus sp*., *Prunus africana*, *Warburgia salutaris* and *Xylopia aethiopica* as well as for some species of rattans, orchids, reptiles, birds, frogs, lemurs and primates. Some of these species (e.g. *Prunus africana*) are included in the annexes of the Convention on International Trade in Endangered species (CITES).

Non-wood forest products provide an important source of income for women. In Morocco, for example, extraction of edible oils from the argan tree, *Argania spinosa*, is mainly carried out by women.

Nature has endowed the Sudan with abundant human, animal wealth and agricultural resources. If this viewed within the context of the country's strategic geographic position, the potential for sustainable economic and social development is clearly feasible. However, these resources are least utilized or exploited and as a consequence the Sudan is currently classified among the least developed 25 countries in the world (El Mahdi, 1995).

The agricultural sector plays a vital role in the Sudan's economy. It provides livelihood for nearly three fourths of the population and contributes over 90% of the country's foreign exchange earnings and generates about 37% of the gross domestic product. It provides food for the population and raw materials for agro-industries. But the most important role of agriculture in the national economy is top generate surpluses for export to earn the much needed foreign exchange, that what makes its productivity and efficiency central to any program for economic recovery (FAO, 1994).

Among the main sub sectors in agriculture, forests, their products and services play a crucial role in the economy of Sudan and its people's life and as in other tropical areas; there is an increasing concern about the different roles that forests and trees play in characterizing and shaping the environment of rural life in the Sudan.

The ecological classification of Jackson and Harrison (1958) describes forest types according to the ecological zones, there are desert, the semi-desert, the low rainfall wood land savanna, the high rainfall wood land savanna and montane forests. The forest vegetation follows the rainfall and soil types. The soil varies from permeable sands with poor water retention, impermeable clay soils in the central parts to acid soils in the south and fertile silt soils along riverbanks.

The most important forest species include; *Acacia senegal* (Hashab*); Acacia nilotica* (Sunt); *Acacia seyal* (Talh) *Balanites aegyptiaca* (Heglig); *Acacia mellifera* (Kitir) and special forest types like; *Hyphaene thebaica* (Dom); *Tamarix indica* (Tarfa*)*; *Khay senegalensis* (Mahogani*)*; Mangrove and Montane Forests' types.

The vital role of forests to the Sudanese economy and the welfare of its population can be indicated in several ways (Badi, 1989). The main sources of fuel are firewood and charcoal. They constitute about 85% of the total energy used annually, and about 93% of the domestic consumption. Almost all the firewood and charcoal are obtained from the natural forests which occur in the Sudan under different ecological conditions. At the same time the national livestock wealth of the country depends on the natural pastures and on trees for fodder.

Timber and a large variety of other valuable products are derived directly from the forests (Badi, 1989). The total annual output of the natural forests can be estimated

Other minor products from the natural forests of the Sudan include; vegetable ivory from palm (*Hyphaene thebaica)*; garad tanning pods from the fruits of Sunt (*Acacia nilotica*); lulo oil from *Butyrospermum niloticum*; laloub, the fruit of *Balanites aegyptiaca* and gungolaize, the fruit *of Adansonia digitata*. However, the indirect environmental values of the Sudan's forests are even greater.

A recent national survey for consumption of forest products indicated that the sixteen states of northern Sudan consumed one million cubic meters of fuel wood. It is also a source of building poles, sawn-timber, railway sleepers, fruits, fodder, thatching materials and gums (annual exports of gum Arabic range between 20-40 thousand tons and earn some 50-120 million us dollars) (FNC/FAO, 1995).

In another study El Hassan in (1996), emphasized that forests represent an important source of energy, food, building materials and income for the people. It provides the local people with fuel wood and charcoal for domestic uses and small industries. FNC (2000) found that, wood fuels constitute 71% of the total national energy budget. Gum Arabic and other tree gums are among the important foreign exchange earners. Poles and sawn timber for construction and furniture are also supplied by forests. The environmental and social roles played by Sudan forests are even more pronounced. Forests and woodlands are the first and the last defense line against desert encroachment southwards. They protect the Nile system watershed and soil against wind and water erosion. They provide job opportunities for some 13% of the Sudanese people in rural and urban communities.

Regarding the situation of these NWFPs in Sudan, it is the same as that in other parts of the world. Studies on non-wood forest products in Sudan are very few and started only recently. In spite of the increasing recognition of the importance and wide use of non-wood forest products, lack of information is the rule rather than the exception. In this respect, information on the quantities, values, areas of production, producers, marketing and distribution chains etc. is rather scarce (Suleiman and Eldoma, 1994).

According to FAO (2002), gum arabic is the most known and most important Sudanese non-wood forest product. Sudan is also one of the world's biggest exporters of Olibanum resins (*Boswellia sp.).*

It was also reported that, other vegetal NWFPs are fodder (e.g. *Zizyphus spp., Acacia spp*.); food (fruits, e.g. *Hyphaene thebaica*; nuts, e.g. *Cordeauxia edulis*; and edible oils, e.g. *Vitellaria paradoxa, Balanites aegyptiaca*); medicines (e.g. *Tamarindus indica*); dyes (e.g. henna *Lawsonia inermis*, *Prosopis africana*); fibers (e.g. *Borassus* *aethiopum*); latex (e.g. *Landolfia ovariensis*); and tannins (e.g. *Rizophora mucronata, Acacia nilotica)*.

Honey and beeswax are the only faunal NTFPs on which documentation exists.

In (1983) Bayumi mentioned, the exact volume of the quantities of the produced and consumed minor-forest products such as *Dom, Garad, Sannameca, Henna* and the other tree fruits was unknown, but (Table 2.4) show the exported non-wood forest products (1979/1981) which might reflect the importance of these products. Similarly Badi, (1989) said that Sudan produces unknown quantities of non-timber forest products.

Table 2.4: Exports of the Sudan Minor-Forest Products (1979-1981).

Product	1979		1981	
	Quantity/tonnes	Value in 000Ls.	Quantity/tonnes	Value in 000Ls.
Sennameca	956	195.171	997	242.339
Henna	94	14.162	73	145.181
Dom	196	7.825	-	-
Ivory	17	39.719	20	91.580
Sunt	-	-	19	2.678
Total	1263	256.876	1.109	481.778

Source for 1979: Forests Administration (1979). Annual Report for the Period July 1974-June 1979.

Source for 1981: The Democratic Republic of the Sudan (Ministry of Finance and Economic Planning) Department of statistics (1981) Foreign Trade Statistics, Annual, 1981, Khartoum.

The forest consumption survey (FNC/FAO, 1995), estimated the total internal trade value of the major non–wood forest products in the marketing centers during 1993/1994 as Ls. 386 million, with *Aradieb*, *Tabaldi* and *Hinna* forming the bulk of the trade. For the same year the survey found that the total turnover from the export of the major non-wood forest products was about US$ 79.77 million which represents 19.35% of the total value of the exports of the country (Table 2.5 and 2.6).

Table 2.5: Production and Internal Trade in Non-wood Forest Products (1993/94).

Product	Unit	Total	Value in 000Ls.	% of Value
Dom	Sack	28000	5763	1.5
Saaf	Tarid	121986	29191	7.6
Laloub	Sack	111753	28710	7.4
Loban	Gontar	37522	23264	6.0
Garad	Sack	20380	1465	0.4
Gunglaize	Sack(de-husked)	137475	72813	18.9
Aradieb	Sack	305590	135864	35.2
Nabag	Sack	111140	36076	9.3
Gudiem	Sack	2805	8230	2.1
Saanamacka	Gontar	20000	2400	0,6
Hinna	Gontar	65000	42250	10.9
Total			386026	100

Source: Summary of findings; Forest Products Consumption Survey in the Sudan/FNC/Forestry Development Project FAO. GCP/SUD/047/NET. May, 1995.

Table 2.6: Export of Non-wood Forest Products (1993/94).

Product	Tonnes	Value million US$	%
Gum Arabic	22735	72	90.25
Aradieb	1005	0.753	0.94
Gum Loban	288	0.549	0.69
Gunglaize	6	0.002	0.003
Hinna	2925	5.47	6.86
Sannamacka	390	1	1.25
Total		79.774	100
% of Total Sudan Exports 412.3 19.35			

Source: Summary of findings; Forest Products Consumption Survey in the Sudan/FNC/Forestry Development Project FAO. GCP/SUD/047/NET. May, 1995.

In another study Badi (1993), adopting the natural distribution of the species according to Jackson and Harrison (1958), produced an exhaustive list of the non-wood forest products in Sudan classified with accordance to their end uses as foods, beverages, medicines, fibers, industrial raw materials, social and cultural.

According to Rahama (1995), tree and forest products are part of the culture of the subsistent and nomadic population in Kordofan state, this enabled people to cope with seasonality. Trees are used by rural people as food, shade, fodder, medicine and as a source of income. The oral history of the Sudan is rich with information about the perennial and seasonal trees, roots, grasses and tubers that are growing in its different regions.

Badri and Badri (1994) also reported that, women in Sudan especially those in deserts and short grass savannah regions have extensively utilized the bio-diversity to give survival to their families. They have as well used their traditional technologies to reserve and store food for periods of shortages and starvation.

Another study documented that Sudanese women have invented ninety different fermented foods and drinks which they get from the environment. Many of these foods are known to be at least two thousand years old (Dirar, 1991).

Baxter (1981) contends that, women in Western Sudan have a considerable knowledge of trees, the different species and their frequency in the region. She found that women can name more than 400 species depending on their age.

The importance of trees stems from the fact that forests cover 38.8% of the total area of the country, and their total wood volume accounts for 1.9 million m3, also forests provide 98% of the total energy consumption of the households (Elassad, 1987).

However, these studies were scattered and not covering all aspects of NTFPs.

CHAPTER THREE

METHODOLOGY

3.1 The Study Area

3.1.1 Location, topography and climate

The study area is Shiekhan Province which is located in North Kordofan State. North Kordofan State lies in Western Sudan, between latitudes 16 3`- 11 15 `N bordered by the Nile State to the north and South Kordofan State to the south and longitudes 27-32 16` E bordered by Khartoum state and White Nile state to the east and south and north Darfur State to the west. The total area of the province is 252,000 sq. km. Studies carried out in the area under investigation found that there are two main geological formations. These are the basement complex and the Um Ruwaba formations beside minor occurrence of Nawa Formation (Mohammed *et. al*, 1982). Basement complex is recognized to be difficult for ground water extraction except in faults and fissures. Mohammed et.al. (1982) reported that, younger intrusive rocks occur in Jebel Ed Dair, Jebel Dambeir and Jebel Ettibna, all in El Simeih (El Rahad area). The largest *Jebel* in this group is Jebel Ed Dair described as a large granite mass which has influenced the patterns of settlements in the area through water bearing pediment surrover lying the basement formation. Tectonic movements in Eastern Africa had resulted in the formation of several structural basins (the Kieran). These basins filled with fluvial and lacustrine deposits during Pliocene and early Pleistocene formed the Um Ruwaba series.

Boreholes drilled into the Nawa formation in Nawa and Kazgeil have proved the formation to be capable of yielding a moderate water supply (Mohammed et.al, 1982). The soils are described as sandy interspaced by silty depressions, where the topography is characterized by stabilized and distributed sand dunes (*Goz*) soil. The silt depressions or clayey pockets have earned the local name of *gardud* (Musnad, 1986). " *Goz* " Soil, being almost pure quartz grains is low in mineral nutrients and deficient in organic matter but is high in moisture availability since it absorbs all the rain that fall on it, while the non-cracking clay soil is a mixture of sand and clay cement to produce non-cracking surface which is impermeable with a high surface run-off and very little moisture available for plant growth "*Gardud*" (Jackson and

Harrison, 1958). The geographical structure of the area ranges from desert with sandy lands and *Gardud Soil* in the north to semi-desert in the middle and the south parts; the muddy lands are found along Abu Habil Basin.

Latitude 13 N represents an ecological boundary that divides the province into two zones, the northern part which is dominated by the light sandy soils (*goz)* and the southern part with the dominance of heavy transitional soils "*gardud*" (Area Development Scheme, “ADS”1993).

Wind erosion is a serious hazard to the soil in the northern *goz* lands and water erosion is a limiting factor to the clayey soils in the southern part of the study area. Compact and crust formations are the main limiting factors in the *gardud* soils. Soils on the riverbanks are moderately or poorly drained.

Ahmed (1989) described the climate of the province as part of the African-Dry Sahelian Zone. The mean annual rainfall varies from under 100 mm. in the extreme north to 400-650 mm. in the south. However, rainfall is characterized by great annual and seasonal variations in amount and distribution. About 90% of the total precipitation in Kordofan region falls within the period July - September, with August as the peak month. The temperature varies between 19.6 and 34.4 C. Inadequacy of rainfall coupled with annual fluctuations rendered the northern half of the region unfavorable for crop farming, and susceptible to repeated shortages of food and famine occurrence equally and because of the drop in rainfall averages in recent years, this same area has lost most of its forage potential of the past, resulting in observed decline of its livestock economy (El Sammani, 1986).

According to Iskander (1986), Northern Kordofan is generally a gently undulating plain of low relief with average altitude ranging from 350 to 500 m. above sea level. This plain is mostly covered by sand dunes and its monotony is often broken by protruding isolated hills or clusters of hills in the form of Insel-Bergs e.g. Abu Sinun mountain (8200 m) and Um Shugeria mountain (846 m) west El Obied, Kaga Serug mountains (From 730 To 835 m) North Um Bel and Abu Asala mountain (835 m) South Soderi. North Kordofan lies within the drainage system of the River Nile Basin. The northern sector of North Kordofan drains its water to the main Nile; where as the eastern and southern sectors are within the drainage basins of the White Nile and Bahr El Arab respectively. Most of the vallies (Wadis) in North Kordofan are ephemeral streams, which flow during and shortly after the rainy season. Practically, little or no run-off reaches the Nile and except for Wadi El Malik and El Mugaddam, the rest of the streams usually end up in sand deltas before they join the Nile.

The mean annual rainfall over the whole area of North Kordofan varies from 75 to 500 mm. this corresponds to an average volume of rainwater of some 50 milliard cubic meters every year (Iskander, 1986). The potential evapo-transpiration exceeds the total precipitation by some 1400 mm/ annum. The recent drought which struck the Sahel area has resulted in a general decrease of some 30% of the total amount of annual precipitation (Iskander, 1986).

A good part of the rainwater flows over the ground, forming surface run-off. Surface run-off either cuts its own course forming *khors* and *wadis* or accumulates in natural depressions forming *Turdas, Rahad and Fulas*, or is gathered in artificial excavations forming *Hafirs* (Iskander, 1986).

Ground Water is the only permanent source of water in North Kordofan tubes generally tap water or open shaft wells drilled or dug in the water bearing formation. Withdrawal of ground water from these wells takes place either manually using a leather bucket and a rope or by diesel driven pumps. Some 60% of the human and animal population of Northern Kordofan depends on ground water for their living (Iskander, 1986). The different rock formations are into two main categories: a) Water bearing formation; which are capable of absorbing and transmitting ground water in sufficient amounts; b) The non-water bearing formation which neither absorb nor transmit or yield water in appreciable quantities (Iskander, 1986). The Major Water Bearing Formations in North Kordofan are:

1. The Alluvial Aquifers.
2. The Um Ruwaba Aquifers.
3. The Nubian Sand Stone Aquifers

3.1.2 Vegetation cover

Rainfall and soil textures are the most important determinants of the vegetation in the area under study. Musnad (1986) reported that, most of North Kordofan falls in the ecological zone termed semi-desert or sand, the vegetation of this zone is a varying mixture of grasses and herbs, with or without bushes up to two meters high interspersed with bare land. The dominant woody species are *Acacia tortilis* (Samar), *Maerua crassifolia* (Sereh) *Acacia nubica* (La'out), *Leptadenia pyrotechnica* (Marikh), *and Calotropis procera* (Usher).

Ahmed (1989) cited that the northern part of the province has no importance for agricultural purposes because of the low moisture availability and low soil fertility. This part is characterized by scanty vegetation that is found only in depressions. This type of vegetation enables the Kababish tribe to wander for long distances into the desert at the beginning of the rainy season.

The southern most part of the province lies within the belt of the low rainfall woodland savanna, where annual rainfall is less than 400 mm. *Acacia senegal* (Hashab) is the dominant species. Other species were also mentioned by Ahmed (1989) such as *Acacia radiana* (Seyal), *Acacia albida* (Haraz), *Acacia milifera* (Kitir), *Adansonia digitata* (Tabaldi), *Balanitis aegyptiaca* (Higlig), *Acacia seyal* (Talih), *Tamarindus indica* (Aradieb) and *Bosica seneglensis* also found with the dominant grasses *Eragrostis tremula* (Bunnu), *Cencrus biflorus* (Haskaneet) and *Aristida spp.* (Gaw). In the area where the annual rainfall exceeds 400 mm. *Combretum cordofanum* (Habil) and *Delbergia melanoxylon* (Babanus) are the most dominant trees and *Guiera senegalensis* (Gubbeish), *Eragrostis termula* (Bannu) and *Aristida pallida* (Gaw) constitute the dominant grasses .

The baseline survey of the (ADS) in the year 1993 found that, the herbaceous plant cover in Shiekan Province is about 5-10% for Um Esheira, 15% for Abu Haraz and 5% for each of Kazgail and Khor taggat rural councils. The densities of plant species have been greatly altered and mostly reduced. However, none of the common trees or herbaceous species have completely disappeared (IIED/IES, 1990).

3.1.3 Land use and human activities

The evident land use types as indicated by Mohammed *et.al*. (1982) are:

(1) Crop production: where people used to cultivate stable food crops (Dukhun and Dura) and cash crops including sesame, groundnuts, karkadi, watermelons and Lubia.

(2) Forestry: with emphasis on the Hashab (*Acacia senegal*) culture and gum production.

(3) Livestock raising

Village land for different uses is under a communal land tenure system. Crops are produced under shifting cultivation practices. The family size being an extended or a nuclear one is the main production unit. Farm size is influenced by soil type, the situation of drinking water supply in the villages during late dry season, the harvest time and the labor available to the family .

In Sheikan Province, a traditional form of control over land use under the Anglo-Egyptian Condominium (1899-1956) was exercised by the Native Administration through the medium of *Nazir*, *Omda* and *sheikh* in the context of tribal homeland. Actual ownership of land has been largely vested in the government. The 1899 Title of Land Ordinance gave absolute title to land to anyone who cultivates it continuously for five years. The Settlement and Registration Act 1925 contained the provisions relating to the registration of private land. The Unregistered Land Act 1970 declared that all land not registered before the commencement of the Act was to be deemed government property and to have been registered as such. The 1984 Civil Transaction Act replaced the Unregistered Land Act of 1970, but reconfirmed the legal position of land not registered prior to 1970 (including all rain fed agriculture lands) as government owned (Mutwakil, 1998).

Native Administration continued to control the resource use all through until its abolishment and replacement by the districts and rural councils in 1971. Tribal leaders laid down rules to organize land tenure in their domain, to regulate the land resource use, and to settle the dispute over land. These rules gave members of the group the right to own a piece of land for cultivation, and gum collection and also the privilege of gum collection from unallocated communal land (Sief El Din, 1985).

Cultivation is reasonably secure in terms of rights. Gum trees on fallow land remain the property of the cultivator but the land itself can be reallocated and fallow lost if there is sufficient pressure to cultivate it. Usufruct rights are enjoyed by all community members for crop farming on the *ghifar (*communal land) under *Sheikh's* (village leader) jurisdiction. Usufructory right of use of trees is lineage based. All tree products, except gum arabic are accessible to the lineage members to use for both home consumption and market regardless of on whose land trees are growing. *Sheikh* assigns every member of the community with a land parcel to be used as a farmland. Wives, sons, daughters and even close relatives may also have usufruct right to the household farmland. They may be given a piece of land to farm or manage separately.

In spite of these subdivisions, land is retained as a shared resource in the extended family (Mutwakil, 1998).

3.1.4 Population

According to the National Population Census of (1993), the total population of North Kordofan State is 1327 066. About 76.8 % of this population is living in the rural parts of the state while 23.2 % of them are urban. Shiekan Province‘s population is 366,573. This figure is 200% and 145.6% of the population size of 1973 and 1983, respectively. About 62% of this population is urban while 32% are living in rural areas. The nomadic population is 4.9%. According to the census, the average compound population growth is about 5.8% for 1993 compared with 3.8% and 3.4% for 1983 and 1973, respectively. The average number of household members is 5.8. The population density in the study area is 32 persons per square kilometer. The population density is low in the northern parts because of the desert nature dominating these parts while the density increases in the central and south parts of the state.

The population composition in the study area can be classified as nomadic and sedentary tribes. Mac Michael (1912) reported the following main tribes in Shiekan province:

(1) Bedayria: A sedentary tribe that has long inhabited the area particularly north and west El Obied.

(2) Shuweihat: That found in the western and southwestern parts of El Obeid Rural Council, they are cultivators.

(3) Hawawir and Gellaba Hawara: The formers are camel- owners’ tribes and the latter are settled near El Obeid.

(4) Beni Gerar: They are nomads and settlers roaming Northern Kordofan State.

(5) Shenabla: The bulk of the tribe are still camel owners, also occupy some areas near the White Nile.

Administratively North Kordofan State is divided into five provinces, namely Shiekhan, Um Rawaba, Bara, Sodari, and Gubrat Alshiekh. Shiekhan Province (The study area) is administratively consisting of only one locality (Mahalia); Shiekhan Locality. This Locality is in turn divided into eleven administrative units, eight administrative units of them were found inside the town (El Obied) and the other three administrative units found outside the town (Rural areas). This study was carried within these three administrative units outside the town. These units namely are Shiekhan Rural Unit (include Um Esheira and Tagat rural areas), Kazgail Unit and Abu Haraz Unit.

3.2 Data Collection

Primary data was collected using a social survey. Three groups of respondents were surveyed:

(1) Households

(2) Informants

(3) Traders

As for the first group standard statistical method for sample selection was used. For group 2 and 3 purposive selection method was used.

3.2.1 Households sample

Being the nuclear base of the local community, the household is selected to be the basic unit of analysis for this study. The primary data was collected from the surveyed population using the questionnaire as a tool for face-to face interview. This technique which was chosen is expensive, time consuming and needs an interviewer who is capable of asking the questions in a clear standardized and concise way, recording carefully the answers and maintaining a good rapport with the respondents, motivating and guiding them through the questionnaire (May, 1993).

In spite of the above-mentioned constraints this tool seemed to be the most suitable one because: 1/ the majority of the respondents were expected to be illiterate (the situation in most rural areas in Sudan). 2/ to avoid any problem with the sample frame. 3/ the interviewer will be able to record and observe even the non-verbal gestures of the interviewee. A structured questionnaire was used for the household respondents where the questionnaire included questions covering the following key areas. Demographic questions about the respondents' tribe, age, and sex, level of education, occupation, income, marital status and number of children were developed and put at the beginning of the interview schedule. Then come questions about land ownership, the cultivated crops, and the sources of income, in addition to information about the type of the activities practiced by the respondents.

Data on the Non-Timber Forest Products (NTFPs) was collected using questions developed to obtain information about, the NTFPs prevailing in the study area and their sources at the disposal of the local people, utilization systems of these products, methods used for collection, distances traveled to the sources of these products, frequency of collection and time spent in collection in addition to their marketing.

The questionnaire was constructed and an expert revised the first draft. This was pre-tested on a sub- sample to determine the validity, reliability and the objectivity of the contents (May, 1993). Therefore 30 respondents were selected and interviewed. Accordingly the questionnaire structure was slightly modified.

Methods for any sampling selection should be based on the time and resources at the disposal of the researcher. The larger the sample size the more accurate the sampling will be. Moser and Kalton (1985) mentioned bias avoidance and maximum precision achievement as major principles underlying all sample design.

For the purpose of sampling validity, it is necessary to use a method of randomly selecting a sample in order to make generalization to the population at large. To increase precision a stratified sampling procedure is necessary to select the household's respondents in this study (Snedecor & Cochran, 1980). Thus a stratified multistage sampling method was used followed by random selection of the sample within each stratum.

The three included administrative units of Shiekhan Province consist of a number of village rural councils (El Obied Statistical Office, 2003) as follows:

(1) Rural Shiekhan administrative unit consists of 50 village’s rural councils.

(2) Kazgail administrative unit consists of 30 village’s rural councils and

(3) Abu-haraz administrative unit and it has 27-village’s rural councils.

Each administrative unit was considered as a separate stratum and since each of these councils, within the units, in turn consists of a large number of villages; each stratum (one administrative unit) was further stratified. The villages within each stratum were stratified into groups of large, medium and small size villages according to the number of households in each village forming a sub stratum. Then from each sub stratum three villages were selected randomly. This came out with a number of nine villages in each stratum (3 large, 3 medium, and 3 small) to reach to a total of 27 villages from the three-administrative units (9 large, 9 medium and 9 small).

The sample frame was the population of Shiekan Province. The total sample size taken for this study was 1% of the total population (29944 households) in the three administrative units, which is equal to 299 households. This sample was distributed to each group of villages using the population proportion to size (pps) approach. Accordingly:

- Rural Shiekan administrative unit, which has 12371 families, a number of 124 households, was drawn from its 9 villages proportionately.

- Kazgail administrative unit that has 8583 families a sample of 86 households was drawn also proportionately from its selected 9 villages.
- Abu-haraz administrative unit, which has a total of 8990 families the sample drawn from its 9 villages proportionately, was found to be 90 households.

Table 3.1 and 3.2 illustrates the allocation of the selected sample. The villages' sample was then drawn randomly from the large, medium and small villages proportionately from a prepared list of population. Eight group meetings with a number of households to elucidate background information were also conducted.

3.2.2 Informants sample (Village Sheikhs, formal and informal leaders

Each community, in urban and rural areas of Sudan has its own leaders, formal and informal. The leaders are a key to the acceptance of external people, such as the social animators or a researcher wishing to undertake a study; their involvement gives confidence to others. They can also influence the others. In fact a good approach to the Village Sheik helps in creating trust in particular between the village people and the researcher as their worries and suspicions towards an outsider will be reduced.

It was therefore planned to interview the Sheikh (Political or Religious Leader) of each village understudy together with other important people including the schoolteachers and popular committee members .

From the three areas a small purposive sample of 22 informants was chosen to respond to the survey of the Village Sheiks, formal and informal leaders. Actually those 22 informants were all those who are available in the villages during the fieldwork.

Unstructured questionnaire was used for the informants' interviews. These interviews are different from interviews scheduled for the household respondents in that they involve a small purposive sample, not structured and larger than the households' questionnaire. The interview is like a guide questions. The informants' interviews were mainly on all aspects of the NWFPs in the study area.

Table 3.1: Allocation of Selected Sample to Different Strata in Shiekan Province

Administrative Unit	Total Number of Households	Selected Villages	No. of Households	Sample Size at Unit Level (1% of(Households)	Sample Size at Villages Level (Households)	Proportionality of the Sample Size at Villages Level
Rural Sheikan	12371	Lrge:3 Medium:3 Small:3	641 225 88	124	83 29 11	67% 24% 9%
Kazgail	8583	Large:3 Medium:3 Small:3	448 183 63	86	56 23 8	65% 26% 9%
Abu-Haraz	8990	Large:3 Medium:3 Small:3	569 170 81	90	62 19 9	69% 21% 10%
Total						

Table 3.2 Distribution of the Sample Size at the Villages Level

Administrative Unit	Name of the Villages	Villages Total Population	Villages Total Sample Size	Each Village Sample Size	% of the Sample Size at Village Level
Rural Sheikan	Large :				
	Um Higlaiga	166		21	13
	El Kaw	337	83	43	13
	Fangouga	138		17	12
	Medium:				
	Bano Eldonki	75		10	13
	Elraboua	95		12	13
	Um Higleig	55	29	7	13
	Small:				
	El Riwaiana	45		6	13
	Um Harazat	26		3	12
	Elniwala Ibrahim	17	11	2	12
	Large:				
Kazgail	Siwalim	85		11	13
	A'aloba	173	56	22	13
	Shoshay	190		24	13
	Medium:				
	Edaidat	55	23	7	13
	Aradaya	65		8	12
	Alibnoya	63		8	13
	Small:				
	El Bidaria	35		4	11
	El Sigour	16	8	2	13
	El Aradaib	12		2	17
	Large:				
Abu-Haraz	Um a'arada	250		28	11
	Abu Ga'aoud	200	62	22	11
	Um Sidir	119		13	11
	Medium:				
	Migaiga	65		7	11
	El Miraikib	60	19	7	12
	Um Oshoush	40		4	10
	Small:				
	Muwadir	36		4	11
	Um Subagha	20	9	2	10
	Khadarat	25		3	12

3.2.3 Traders sample

Traders were chosen as part of the survey sample for this study to give information about the marketed NWFPs, their markets as well as the problems associated with the marketing of these products. Therefore a total of 21 traders (those possible to be interviewed, available at the time of the survey and have time to answer the questions of the researcher) were interviewed as follows:-

- Fourteen traders from the different villages' selected in the sample of households (see section 3.2.1).
- Seven traders from four different local markets (located inside the study area) distributed as follows:
    - Tow traders from kazgail market that located in khazgail rural area.
    - Tow traders from Wad Eikafa market.
    - Tow traders from Abu Gahal market.
    - One trader from products market (Soag Mahusolat) El obied.

The last three markets are located in El obied town. For the traders Interview a semi-structured questionnaire was used.

3.3 Data Analysis

Data obtained from the household questionnaire was analyzed using the Statistical Package for Social Surveys (SPSS).

Descriptive and ANOVA analyses

Descriptive statistical methods were applied to data concerning social characteristics and respondents perspectives about the different aspects of the NWFPs production activities. Summary information of the socio-economic characteristics of the study sample was obtained in form of frequency, percentages, distribution and cross-tabulation. Pearson chi-square for cross tabulations was used to determine the significance of the relations among different variables in the cross- tables.

The types, quantity and characteristics of the NWFPs in the study area were presented using frequency, distribution, range, mean, sum, standard deviation, variance, minimum, maximum and standard error mean. Means separation for the collected quantities of the different products in the study area was obtained using one- way analysis of variance and post hoc tests (LSD).

Logistic regression analyses

The probability of the household's participation in the collection of NWFPs and the factors affecting it were studied using the non-linear binary logistic regression model (Madalla, 1983). Logistic regression model is the statistical technique advocated by Hosmer and Lemeshow (1989) for estimating the probability that an event occurs or not. In other words, the interest is in predicting which of two possible events are going to happen given certain other information.

This model requires far fewer assumptions than discriminant analysis; and even when the assumptions required for discriminant analysis are satisfied, logistic regression still performs well (Hosmer and Lemeshow, 1989). In logistic regression the probability of an event occurring is directly estimated (Norusis, 1992). What distinguishes a logistic regression model from the linear regression model is that the outcome variable in logistic regression is binary or dichotomous (Hosmer and Lemeshow, 1989). This difference is reflected both in the choice of a parametric model and in the assumptions and once the difference is accounted for, the methods employed in an analysis using logistic regression follow the same principles used in linear regression.

For the case of a single independent variable, the logistic regression model can be written as follows:

$$\textbf{prob (event)} = \frac{e^{B_0+B_1x}}{1+e^{B_0+B_1x}}$$

Or equivalently,

$$\textbf{prob (event)} = \frac{1}{1+e^{-(B_0+B_0x)}}$$

Where *B0* and *B1* are coefficients estimated from the data, *X* is the independent variable, and e is the base of the natural logarithms, approximately 2.178. For more than one independent variable (like the case of this research, where the probability "*prob*" of the household's participation in the collection of NTFPs is estimated using this logistic regression model.), the model can be written as:

$$\text{prob (event)} = \frac{e^{z}}{1 + e^{z}}$$

Or equivalently,

$$\text{prob (event)} = \frac{1}{1 + e^{-z}}$$

Where Z is the linear combination

$$Z = B_0 + B_1X_1 + B_2X_2 + \ldots + B_pX_p$$

The probability of an event not occurring is estimated as:

Prob (no event) = 1- Prob (event)

The probability estimates are always between 0 and 1, regardless of the value of Z. The logistic regression model was also used in this study to estimate the probability of the households' demand for recreation provided by the tree resources found in the study area.

The Pearson chi-square test and the t-test were the statistical test procedures applicable in more general problems and usually use to indicate whether there is a relationship between a dependent variable and an independent one. The relationship is considered significant if any variation is reported. This could usually be indicated by the value of the computed significant coefficient; normally a value of ≤ 5% is an indication of an acceptable significant variation of a dependent variable caused by an independent parameter.

The Pearson chi-square test is based on comparing the observed table values with estimates of the expected values that are obtained assuming that H_0 (null hypothesis) is true. The Pearson chi-square is defined as (Owen & Jones, 1982):

$$X^2 = \sum \frac{(O - E)^2}{E}$$

Where O is the observed frequencies obtained in the sample. And E is the expected frequencies on the basis of the null hypothesis. Descriptive statistical methods were applied to data obtained from the traders, informants sample and group discussions concerning respondent's perspectives on the different aspects of the NWFPs production and trading activities.

Odds and odds ratios are measures of association. The odds are the probability (p) that some condition (e.g., y=1) exists divided by the probability that it does not exist (1 - p). Odds ratios are measures of relationship (effect size). The odds ratio is a measure of the strength and direction of relationship between two variables. If β is the coefficient of logistic regression for a certain variable, e^{β} is an indicator of the change in the odds because of a unit change in the explanatory variable. The estimate of β has an appealing interpretation in terms of the odds ratio

$$Odds = \frac{\Pr(Y_i = 1)}{1 - \Pr(Y_i = 1)}$$

$$Odds = e^{\alpha + \beta X_i}$$

Taking logs:

$$\ln(Odds) = \ln\left(e^{\alpha + \beta X_i}\right) = \alpha + \beta X_i$$

The log of the odds is a linear function of X. As the independent variable increases by one, the log of the odds increases by 'β' units. To know how much the change would be in terms of the odds (rather than the log of the odds) it could be shown that, as e^{β} is an indicator of the change in the odds because of a unit change in the explanatory variable, if $e^{\beta}=2$ this means that increasing the an explanatory variable (say income) by one unit increases the odds of a dependent variable (say participating in NWFPs collection by a factor of 2 (increase in 100%) so that:

Odds after increasing income/ odds before increasing income = 2

The effect of a unit change in X on the log odds of the event occurring is thus given by the β coefficient. This ease of interpretation represents one of the reasons for the popularity of the logistic model.

It is known that the logistic regression coefficient b is the change in logit (p) due to a unit change in x, where p is the probability that y=1. While this is analogous to OLS regression, it is has little intuitive meaning. Therefore, the odds ratio is used to interpret the b's.

Odds ratios are common measures of association for two variables. The odds ratio is one odds divided by another for the second variable, such as the odds of participation in NWFPs for the second variable income. The odds ratio is the natural log (base e) to the bth power for one independent variable equations. For instance, if b = .25, then the odds ratio is $e^{.25} = 1.28$. Therefore, for each unit increase in x, the odds that y=1 change by 128% (increase by 28%) from their previous state. In the case of multivariate logistic regression, the odds ratios are interpreted the same but one must add the caveat "when all other independent variables are held constant."

- An odds ratio below 1 indicates a decrease (that is, a unit change in the independent variable is associated with a decrease in the odds of the dependent being 1 in binomial logistic regression, or being the highest value in the case of multinomial logistic regression).
- An odds ratio above 1 indicates an increase (that is, a unit change in the independent variable is associated with an increase in the odds that the dependent equals 1 in binomial logistic regression, or being the highest value in the case of multinomial logistic regression).
- An odds ratio of 1.0 indicates the two variables are statistically independent.

The odds ratio cannot be used to compare the relative strengths of the independents. The standardized logit (effect) coefficient is used for this purpose.

CHAPTER FIVE

Discussion &Conclusion

5.1 Implication of the social characteristics of the households

Farming is the major activity throughout the rain fed study area representing the primary occupation for the respondents regardless of gender or education level. In addition, an important characteristic is that about half of the households are headed by females. Because farming does not employ the inhabitants all year round, its seasonality (May-October) pushes households to seek other types of employment during the slack period.. Thus collection of NTFPs is one of the off-farm activities for most farmers and is a main source of income for more than 13% of households during the dry season. In a survey conducted by FNC covering the gum producing states, it was found that on average, income from gums represent 19% of the household total income[1] . Although in this study the contribution of non-gum NTFPs to total income is not clear, due to difficulty in estimating total income, it is evident that it is a reasonable portion at least during dry season. However, those have income from this activity mentioned that it varies between $100-300 / annually. Also (Kilby and Liedholm, 1986; Haggblade and Hazell, 1989) mentioned in rural areas, the rural non-farm work provides 30-50 percent of rural household income, and confirmed again by the results of the surveys conducted by (Liedholm and Mead, 1992) in the small enterprise sector which showed that small forest-products activities everywhere account for a substantial proportion of the total.

The absence of males in a substantial number of households signifies the pattern of rural-urban migration, which has become a fact in Sudan as well as in other developing countries because of insufficient opportunities in rural areas. This is supported by other findings which indicate that the average age class of current heads of households is 40-45 years, and that more than half of the total number of the respondents were at the low level incomes scale $ 0-300 /year while the average national income is $ 160 / month, add to this the finding that variation in education level or gender does not change employment opportunities for the respondents. All this reflects the poor quality of life in Shiekan rural community. Poverty and poor

[1] - Development of gum Arabic production and marketing project (Sudan) (TCP/SUD/7821)

quality of life are interrelated and in many areas, they are the cause of social disorders and decline in environmental quality (Shepherd, 1998). Land-based natural resources in rural areas are usually the most affected by these disorders as they are either misused or neglected due to mass migration (Kleinn et.als., 1996). Receiving urban areas are congested by marginally employed unskilled labor.

5.2 Implication of the relationship of social factors to collection, use and marketing of NTFPs

5.2.1 Collection

Types & products

The common collection system for the NTFPs usually harvested in the study area practiced by the local households under rights bestowed was for utilization at home level and sale in the local markets. Fuel wood is collected by households for use (mainly firewood) for cooking purposes where fuel wood is the only source of fuel. This means that fuel wood thus collected is a basic-need good that poor households has to get for their basic survival and therefore its availability at affordable prices is a major social concern.

Results indicated that collection sites are variable which reflects the variation in availability of firewood from site to site depending on the tree density in the particular site. Very few households would purchase their requirements of fuel wood as was also stated by FNC and FAO (1995) that 82.19% of firewood consumed in rural areas was collected.

Fuel wood, particularly firewood constituted the major source of energy for cooking in Shiekan Province. This was in line with what was mentioned by FNC and FAO (1995), that the rural households show dependency of 85% and 32% for firewood and charcoal respectively. This means that firewood although in many places is an inferior good, is a basic-need good in the study area. Also Mutwakil (1998) mentioned the use of fuel wood as a primary source of energy and charcoal as a secondary source in Shiekan province.

Although the study reveals that only lower branches of trees or fallen wood are used for fuel wood, which might be a sign of pro-environment behavior, when natural resources-based goods such as wood are not affordable or unavailable at convenience, mismanagement and/or misuse of such resources is expected and will soon lead to irreversible damage in such fragile environments as that of North Kordofan. Provision of wood or other energy sources (such as gas cylinders) at a convenient and affordable prices to poor communities are the responsibility of local state or organized communities rather than individuals because losing control on such resources for the benefit of people will lead to un-sustainability of the resource and more importantly of the rural life.

The gender dimension in fuel wood collection is signified as women do most of it. This is not surprising as fuel wood is an important input in food preparation which is women's duty in most of households in most African regions (Falconer, 1990), although men are involved when the sale of wood was concerned.

NTFPs other than fuel wood are collected because households also perceive certain benefits from such goods, ranging from direct benefits perceived by the majority of respondents such as food, traditional medicine and income generation; to indirect benefits (perceived by fewer respondents) such as increasing soil fertility and climatic amelioration.

The number of species used to be collected by each household regularly was found to be varied; three products on average were generally collected by each household.

Nabag (the product of *Zizyphus spina-chrisi), Laloub (*the product of *Balanities aegyptiaca), Gunglaize (*the product of *Adansonia digitata), Garad (*the product of *Acacia nilotica), Aradieb (*the product of *Tamarindus indica), Sannamaka (*the product of *Cassia senna) and Gudiem (*the product of *Grewia tanex)* were found to be of the most significant importance as they were heavily gathered and used by the different communities at Shiekan rural areas. This was indicated by the large number of families documented to be involved in the collection of these specific products. This might be due to the abundant amount or domination of these species in this region or due to their significant value to the households in these regions.

However, the collection and utilization of these products for many purposes in different parts of the country was confirmed by Badi (1989 and 1993), FNC (1995), Vogt (1995) and FAO (1997 and 2002).

Besides serving as income generating products these products used as food particularly during times of scarcity and famine. Shiekan Province lies in an arid environment with recurrent drought and famine. Elsewhere in Africa under similar circumstances NWFPs provide important foodstuffs, in particular during the "hungry season" and in marginalized areas (FAO/FRA 2000).

These products varied also according to their sources. The majority of them were found to be of vegetal nature, usually gathered from large woody trees and shrubs and few of them were grasses or herbs. Rabbits, fishes and one type of birds are the only faunal NTFPs among those existing in the study area.

FAO (2000) mentioned the collection of NWFPs all over Africa in all kinds of habitats, woodlands or shrub lands (mainly in arid zones). Many products are derived from trees or shrubs outside the forest located in agricultural fields, fallow areas or home gardens.

Patterns & Methodology

The collection of these products took place in the morning, for most of the interviewed households mentioned early morning as the preferred time for collecting all these products. Very few of them said the collection of these products was performed in the afternoon or during the evening. This most probably because of the hot suns that characterizing the dry season during which this activity was conducted. This is supported by the findings that the respondents usually walk long distances to collect these products from their sites. However, another result indicates that the shortage of drinking water and far distances are among the constraints facing the collectors of NWFPs in these regions.

The time consumed in the extraction of NWFPs in the study area showed variation. This variation might be due to the variation in the nature of these products and hence variation of the methods of extracting them. Or most probably this was because that the inhabitants used to practice the collection of these NWFPs along with other activities, such as part of the agricultural activities, herding or fuel collection. This was definitely happened according to the variation in the timing of flowering and fruiting of these species and so each product has its own period of extraction within this length of time. This might be confirmed by the fact that, active collection of the NWFPs existing in this region was concentrated within the months (October, November, December, January, February, March, April, May) which witness the fruiting time of all these products (Al Amin, 1987). However, the extraction of these products happens to follow directly the actual agricultural season indicates the potentiality of these products to meet the needs of these farmers for cash during this dead time of the agricultural activities.

The frequency of collecting the NWFPs available for the households in the study area annually, vary as the results indicate. Although the majority of the households collect these products at a frequency of 1-10 times/annually, this frequency might reach 40 annually for most of the products. This was of course governed by the periods of fruiting of these products and the possibility for the households to extract them within that period of time. However, Arnold (1995) said that, the cycle of harvesting varies from a few weeks (e.g. for tender shoots), to longer periods as in the case of mature fruits or rhizomes. On the other hand this shows the potentiality of the collection of these products to employ the inhabitants throughout the dry season. However, this was also confirmed by (Kilby and Liedholm, 1986; Haggblade and Hazell, 1989) who said that rural non-farm work provides 20-45 percent of full-time employment in rural areas.

Considerable variation in the techniques of harvesting these products was also detected. This might be due to the fact that these NWFPs could be considered as a heterogeneous group. At the same time there were no advanced harvesting techniques as such for the various NWFPs in the study area. Simple techniques and tools that involved no external inputs were used. For *Nabag*, *Laloub* and *Garad* the majority of the collectors said that they used to collect the fallen fruits from the ground. Another smaller groups mentioned cutting while standing on the ground by using sticks or climbing the trees, as the means for extracting the fruits or leaves of these three products. As for *Gunglaize* and *Aradieb* those collecting these products used to climb the trees to get them whether in form of fruits or leaves, also another considerable number of the collectors said that they usually use sticks, *gabada* or *muhgam* to extract the fruits of these products. The huge large feature of these two trees and the ways the fruits were attached might be the reason behind the need to climb or using tools for extracting *Gunglaize* and *Aradieb*. *Gudiem* and *Sannamaka* were collected by cutting them directly by hand from the shrubs (usually the collector hold the branch and turn all the fruits on it at once and then go to another one). As for *Gudiem* few people said that they might collect the product from the ground or use stick to get these fruits. In the case that the fruits were collected from the ground, the collectors usually spread straw or hay under the tree to get a clean product. This research does not investigate whether these techniques make sense in terms of time, economic return or their environmental impact. However, it seems that these producers adapted to these techniques, although the difficulty of collection such as pests and insects, thorns on trees and other dangers considered by the respondents as constraints facing the collection of NWFPs might be as a consequence of these harvesting techniques.

Post harvest care was poor in most cases of non-timber forest products enterprises, and wastage was high. Wastage happened in quantitative and qualitative terms during collection, transport and storage (FAO, 1995a). In our case, with respect to the NWFPs for subsistence, local use and marketing, processing involved was mostly in the form of post-harvest treatment or intermediate processing. However, simple forms such as cleaning, shelling, chipping, drying, fumigation, grading and sorting, bundling and storage were mentioned. The majority of the respondents attributed their treatment of these products to the market demand. On the other hand the NWFPs understudies were not delicate and could stand rough handling and long storage terms.

However, harvesting is the activity linking resource management and resource utilization and thus influences resource sustainability, hence, planning and introducing more efficient harvesting methods and systems to control the harvesting operations are essential for utilizing these resources on a sustainable basis.

On the other hand post harvest care training programs for the collectors to be organized by local authorities or NGOs are needed; this may hopefully result in improving post harvest treatment and so enhancing the market value of these NWFPs.

Property rights

Regarding the sites and distribution of these products in the study area and their accessibility for the people in these areas, the results revealed the presence and distribution of these resources all over the surroundings of these villages, inside the villages [*Balanities aegyptiaca*] and within the agricultural lands (family and *ghifar* lands). Some of them were also found in forests whenever they found in the study area (natural, planted, reserved or unreserved, governmental or community forests). However, it could be said that these sites supply the inhabitants in the study area by different amounts of different available NWFPs.

The agricultural lands, however, whether they were family lands or *ghifar lands* represent the major site for these products in this region. For the majority of the interviewed households, the communal woodland (*ghifar*) was the main site from which they used to collect their NWFPs. While a lesser number of households confirmed their collection of the NWFPs from family lands or forests wherever found. This happens although these producers have to go more long distances to reach *ghifar* lands for the mean distances to family lands and forests were found to be less than that to *ghifar* lands.

This might be due to the fact that land ownership – and free accessibility to the resources was vital in securing the inhabitants' needs whenever found. In addition to the fact when forests found there were restrictions on the inhabitants' forest activities because they were reserved or under reservation by the government. Or this behavior could also be because the common resources are richer.

Fuel wood is mainly collected from communal lands (*Ghifar)* and family land regardless of gender of collectors. Collection from communal land is strictly accessed to members of the community while family land is restricted to family members. However, collection from public forest land (government lands) is usually by permission but can also be by illegal cutting.

Implicitly households collect or cut wood by illegal means when a specific good is not available at family or communal land and given the low-income level can rarely be purchased if there are other ways, albeit "illegal", of obtaining the good. This reflects either that public wood or forestlands are subject to mismanagement and protection by the state or that households are compelled – by the need – to act illegally despite the risk of being caught.

However, as was indicated by the results, the collection of NWFPs from *ghifar* land was a common property to all inhabitants of the study area, where every one in the community has free access to the trees in these lands throughout the year. Where as for the family land, the NWFPs, trees and their products are deemed to be a family property, this means that the family has the right to collect these tree products and control other peoples' access to that specific land unless they have permission. This clearly reflects the land tenure system prevailed in Shiekan Province where the usufructuary rights were enjoyed by all community members for crop farming on *ghifar* (communal land) under *Sheik's (*village leader) jurisdiction. Usufructuary right of use of trees was lineage based. All tree products were accessible to the lineage members to use for both home consumption and market regardless of on whose land trees were growing (Mutwakil, 1998).

However, this was confirmed by what Pinedo-Vasquez et.al. (1990) cited in Arnold (1995) saying, the greater part of the raw material supplies that user of NWFPs draw on comes from land that they do not control. Privately owned land or land controlled by private concessionaires, state land managed by forest services or other government departments, or common pool land operated under collective control or without any form of control at all "open access".

All the family lands were usually found around the villages and within their borders. This means that the people need not go far to reach the trees that found on their own lands. Arnold (1995) mentioned that bush fallow or farm bush may be as, if not more, productive of foods and other products as the pristine forest; people may adapt by drawing on a wider range of edible plants and animals. A recent study in Sierra Leone found that the greater part of locally used NWFPs came not from the forest but from fallow and farm bush. The four species used most frequently for constructions were all fallow not forest species. Only 14 percent of all hunted or collected foodstuffs derived from forest itself, and 32 percent of the medicinal plants. Moreover, the most used bush meat species, the rodent "grass cutter", is found only under open cover; it does not occur in the closed forest (Davies and Richards, 1991).

FAO/FRA (2000) indicated that NWFPs are collected in all kinds of habitats, whether in closed or open forests, woodlands (e.g. miombo woodlands in East and Southern Africa) or shrub lands (mainly in arid zones). Many products (e.g. shea butter) are derived from trees outside the forest located in agricultural fields, fallow areas or home gardens. Plantations have been established for species providing high-value products mainly traded on the world market, such as *Acacia senegal* or *Cinchona spp*.

In many developing countries, people have historically had relatively unrestricted access to forests. Poorer people have thus been able to exploit the forests for food, fuel and marketable products. While forest gathering activities are not restricted to the poor, they do depend on these activities to a great extent. Women often dominate forest-gathering activities, both for household products and income. In addition, the low establishment costs of many forests-based small-scale enterprises tend to make them accessible to women and the poor (FAO, 1991). And in communities where NWFPs support the livelihood of millions of people there is an increased competition for tenure and use/access rights, usually to the detriment of the weaker (e.g. women; the poorest) when the resource is scarce, specially where there is a prevalence of common property regimes e.g. in Africa (FAO, 1999).

In our case the extraction activities of the NTFPs in the rural areas of Shiekan Province were apparently dominated by women. Where about 91% of the respondents mentioned the woman as the one who used to collect these products, the children also found to participate considerably in this activity. Men were rarely involved in it. This confirmed what was mentioned by Suleiman and Eldoma (1994) that, women and children play an essential role in the production of NTFPs in Sudan rural areas. During the production season, women and children collect these products from the vicinity of their villages, and even from remote areas.

However, this means that women involvement in these activities was not restricted by any factors and it does not intervene with their other reproductive roles.

Falconer and Arnold (1991) reported that, the evidence suggests women dominate and favor NTFPs gathering and processing which is in line with this case. This maybe due to the: ease of access to forest resources; possibility of combining subsistence gathering with income earning activities; flexibility of location of enterprise, near home, and may be their knowledge about forest products through subsistence use.

5.2.2 Utilization

The utilization of the NWFPs prevailing in the study area varied with the variation of the parts of the products which were usually used by the households in these regions. For the majority of the NWFPs understudy the fruit was the main part that most of the respondents use. Where as the leaves of many of the products found to be used by a wide range of households the other parts such as seeds, branches, flowers, stems, and roots were also mentioned to be used by the respondents in a lesser manner.

While the main uses of most of the concerned NWFPs in these rural areas appeared to be confined mainly in energy, food, drink and medicine, other considerable uses were referred to by the households such as forage, cosmetic and some home industries.

The utilization of these products was said to be by all members of the studied households, and the period of use although it was confirmed to be throughout the year, a large number of the households mentioned their utilization of these products during Ramadan and during the harvest time. This might be due to the fact that these products enter in the preparation of many foods and drinks specified for Ramadan, and also during harvest the people were so busy and these snacks seemed to be suitable for such a situation. This confirm what Arnold (1995) had said that, NWFPs are valued as snack foods throughout the year. They are commonly eaten on the job, while working in fields, while herding and while gathering fuel wood. Forest fruits and nuts are the most common snack foods, especially for children. Also in a study undertaken in Swaziland it was found that some types of forest' fruits are regarded particularly as children’s food, and are eaten on the way to and from school (Ogle and Grivetti, 1985).

Considerable annual quantities were evident to be collected from the most popular NTFPs in the rural areas of Shiekan Province…. *Nabag, Laloub, Gunglaize, Aradieb, Garad, Gudiem and Sannamaka…*for a large number of households distributed all over the study area, were found to be involved in the collection of these products. The maximum collected quantity was found to be from *Garad and Sannamacka* products respectively. This was most probably due to the small number of the collectors, competing on these products’ resources, compared with those collecting the other products, or might be due to the high prices of these products and so the collectors found themselves motivated to collect all these amounts.

Almost all the households were found to consume, but, small part of these products. This is in contrast with what was found by a study from the Philippines that, not less than 46 percent of the total multipurpose tree products production, which include many NWFPs, went for home consumption while 10 percent was given away to neighbors and relatives. Only the remaining 44 percent were sold. This implies that small farmers catered more to consumption on a subsistence level than to markets (Raintree and Francisco, 1994).

The results of the one-way analysis of variance for detecting any differences, between the quantities means of the major NWFPs that collected by the respondents, that might be attributed to the respondents’ socioeconomic characteristics shows that, the mean quantities of *Nabag* collected in the three units, UmEishera, Khazgail and AbuHaraz are not significantly different. This must probably due to the distribution of the *Zizyphus spina-christi* trees all over Shiekan Province. On the other hand, the mean quantities of *Gunglaize* collected from Khazgail unit are significantly more than that gathered from the other two units; this could be due to the concentration of the *Adansonia digitata* trees in these parts of the Province. Also the effect of the variable unit was evident from the significant differences between the quantities of *Laloub* product which appeared to be in favor of UmEishera households. As for *Sannamaka, Aradieb and Gudiem* no significant differences were detected. Regarding the *Garad* product the mean quantities collected by the households of UmEishera unit was significantly more than that collected within the other two units this also might be due to the fact that in this unit found Elaine reserved forest where the *Acacia nilotica* trees were abundant.

When considering the other variables, respondents' age, gender, position in household, marital status and education level, the results obtained showed that there were no significant differences, between the quantities mean of all the products collected by the studied households, attributed to these variables, except in the case of *Aradieb* and *Gudiem* where the quantities collected by males were significantly smaller than that collected by females for both products. This may have resulted from the fact that females are more efficient compared to males and would hence opt to collect products with higher value to them.

On the other hand the mean quantities collected were not significantly affected by the education level of respondents except in the case of Sannamaka, where those with *khalwa* education level seem to collect higher quantities than other groups. The fact that some collectors have *khalwa* education may not have specific implication for the quantity of *Sannamaka* collected.

5.2. 3 Marketing

One can realize the widely dispersed and ephemeral nature of the markets of the NWFPs in the study area. And from the survey results one can predict the situation and patterns of marketing the NWFPs in this region, where the bulk of trade in NWFPs was local-being sold between households and traders, inside the village or other rural markets. Trade, in its limited sense was the act of exchange of products for money or other products, i.e. the transaction; the medium of exchange may be money or barter (FAO, 1995b).

The households usually sell the products they gathered to retailers in the village, trading intermediaries in the village i.e. in their own villages or neighbor villages, in nearby trade towns or to wholesalers in Elobied Town, which is a big town inside Shiekan province. These retailers and intermediaries in turn take these products to trade towns in the nearby or to Elobied or sometimes to Omdurman market in Khartoum province, which was known to be the largest market for NWFPs in Sudan. Some of the households used to collect the *Garad* product said that sometimes they sell the product directly to a tannery found in the region.

In all the surveyed villages in this region, nearly all the interviewed households gather and sell part of their extracted non-timber forest products. It could be said that, these families get revenue or some income from selling these forest products which for many (42.5%) enter into their living expenses. A significant part of local trade on NTFPs in the study area took place through bartering as well.

It is also evident that in most households mothers are the ones who market the collected NWFPs although the income is not received by them in all cases. This is also true for the other categories. This might be due to the fact that although household members carry out marketing individually, on average the household shares the revenue collectively. On the other hand most of respondents would sell at the village market or in the larger markets of Elobied and Khazgeil, regardless of the member category of the household.

The expanding domestic trade flowed to supply urban markets have given rise to often-complex structures of producers, transporters, and traders, wholesalers and retailers, which employ very large numbers of people (FAO, 1995b). This was evident from the findings of the traders' sample which gave a comprehensive view of the trading of these products within these areas, where a variation in the trading manner of these products appeared. Eight of the interviewed traders used to buy the products from the producers (all of them mentioned women as the sellers of these products) directly, without having shops or specific sites in the markets. These traders used to go to the women in their houses and got the products from them or in some cases the women might come to these traders. The traders take these products for cash; they give the women their money immediately or later after selling the products. Some of these traders mentioned that sometimes some of the women might ask them to save the return for them till they need it.

These traders in turn sell the NWFPs they bought from the producers to other beneficiaries. They either take them to urban markets, in this case they usually go to Wad Aikafa or Abu Gahal markets at Elobied or they might go to Omdurman market, *Sannamaka* was usually taken to products market (*Soug Elmahsoulat*) at Elobied, also those who trade in *Garad* said that they might sell it for tanneries in the region. Or they might take these products only to other rural markets in nearby trade towns. Or they might sell them in their own village market on the market day, for intermediaries who take these products to urban markets.

For the rest of the interviewed traders three were retailers having shops inside the villages. These retailers used to buy the products directly from the women who collected these NWFPs or from intermediaries. The households exchange these products either for cash or barter it by consumer goods. These retailers in turn follow the same chain as the previous group of traders, according to the quantities they have. Another group of the interviewed traders (5 of them) was found to deal with these products from the village markets. These markets are on weekly basis; they might be once or twice a week. These traders usually keep certain sites in the market, after paying fees against it for the local authorities and from these sites they undertake their trading of these products. These markets are very simple not organized in a specific manner; each trader has his goods put in sacks and baskets on the ground.

These traders in most cases buy the products from the producers directly and for cash. The products these traders got from the producers might be sold to intermediaries or taken to nearby markets or they might be sold in urban markets later.

Three wholesalers and another two retailers from urban markets within the region were found to be part of this chain. One of the wholesalers and a retailer were from Wad Aikafa market, one wholesaler and one retailer again from Abu Gahal market while the third wholesaler from products market (*Soug Elmahsoulat*). All these traders used to buy these products from the producers, middlemen and traders. Sometimes some of the wholesalers might sent their men to the productive areas to buy these NWFPs from there. The wholesaler from products market (*Soug Elmahsoulat*) mentioned that some of the women work in the collection of *Sannamaka* used to send their products with the lorries to certain people at the market to follow the sell of their products instead of coming themselves so as to reduce the expenses.

According to the surveyed traders, Wad Aikafa market usually serves as a hub for NWFPs trade throughout North Kordofan State, (Shiekan province) the study area is one of its provinces. This market usually drawing the goods in a central point and redistributing them to other markets.

In the urban markets in addition to the traded products collected in the study area and mentioned by the surveyed households another types of NWFPs were found to be available. These products, mainly *Dom (Hyphaene thebiaca), Abulaila (Detarium macrocarpum), Honey, Beeswax* and products made of *Saaf*, come from other provinces of North Kordofan State and from South Kordofan State and they were used to be parleyed between the people in these regions.

The producers in the study area used to carry the non-timber forest products in sacks, baskets or trays (*Tabag*) on their heads to homes after extraction. As for the markets they might carry the products on their heads to the village markets or used other means of transportation such as animals (donkeys or camels), Carro or Lorries, according to the position of the market.

Most communities do not own or have access to efficient, reliable and cost-effective systems of transport. This is true not only for getting into forest areas, harvesting products and transporting them out of the forest, but also for getting the product to markets (or better markets), to their own warehousing or processing facilities, or getting processed or semi-processed goods to the next stage on the marketing ladder. One of the main problems with transportation is scale. It is often the case that non-timber products are cumbersome for individual harvesters to carry, yet they are seasonal that their transport does not justify the purchase of any kind of animal or vehicle solely for that purpose. It is also the case that the weather or seasonal variations can often make it difficult if not impossible to arrange for the right transportation ahead of time in an efficient and cost-effective way. In other instances, the produce of one harvester does not allow that individual to purchase, or even rent efficiently, appropriate transport (Clay, 1995).

However, in mind the above market chain and what noted by many authors earlier that poor gatherers are often exploited by middlemen who control access to the market, supported by the findings of the constraints facing the marketing of these NWFPs in form of low prices accompanied by their fluctuation, one can say, while these forest based activities provide some means of existence to the poorest, they may not provide any means for future investment or for improving their quality of life unless there is some sort of political intervention that could be represented in government regulation and support programs to such inefficient and unstable market systems.

5.3 Implication of the logistic model analysis

When considering the probability of participation of the surveyed households in collecting the NWFPs available in the rural areas of Shiekan province and the factors affecting this participation, it worth mentioning that, factors affecting NWFPs-picking have not been examined before in Sudan, even outside Sudan. These factors have been examined only separately and the method used in such studies has frequently been that of cross-tabulations. Studies that have made use of any kind of modeling approach have been rare, from the results obtained from the model of the binary logistic regression, (As far as many other consumptive or non-consumptive wildlife uses are concerned, the more frequent method has been to explain participation by means of modeling factors, and the results have been used to forecast recreational demand “e.g. Hay and McConnell 1979, Walsh et.al. 1992”), it was evident that the factors affecting this participation could be divided into two broad categories, socioeconomic factors and resource variables. The socioeconomic category includes variables relevant to household's economic performance and variables pertained to personal and demographic characteristics. While the resource variables include those pertained to land tenure in addition to factors pertained to the dealing with the product itself, whether regarding the collection during the extraction process or after it, the time of collection and that spent in collecting the product beside the frequency and quantities obtained, in addition to the uses, the parts used and the revenue from selling the product.

To have a more comprehensive overview of the underlying structure of the households involved in the process of collecting these NWFPs, the factors affecting participation in the collection of the most popular NWFPs in the study area were tackled separately for each product of the concerned NWFPs, namely (*Nabag, Gunglaize, Laloub, Aradieb, Gudiem, Sannamaka and Garad*) as the results show.

As the results indicate the model reflects the fact that the changes taking place in the participation of the respondents in collecting NWFPs for probably all the products could be attributed to socioeconomic factors or resource variables, at the same time these factors collectively affect the participation of the households in the collection of all NWFPs in the study area, which means that collection of NWFPs does not contradict with the traditions or habits of the people in these regions.

Upon analyzing the effect of each of the socioeconomic factors on participation of the households in the collection of the NWFPs in the study area the results revealed that, these factors vary with the different products, generally it could be said that the participation in the collection of most of these NWFPs in the study area was popular more among those with low incomes and that the collection of these NWFPs from the family lands was restricted, and it was carried by the females and illiterates and at the same time conducted by households members from different age groups. The collection of these products was carried along with other off-farm activities. The respondents mentioned that gathering was done while working in the cleaning of the agricultural fields, or herding. This means that this activity does not make any distraction from work.

The majority of the families collecting NWFPs were found to participate efficiently in their collection regardless of the revenue, collected, consumed or sold quantities of these products. The families being large in size have no effect on the participation of the collection of these products as such.

The effect of all these factors; confirmed by the perception of these producers as they see these products as food, medicine, income generating and others, and in line with what was mentioned by (Shepherd (1998); Arnold (1995) and FAO (1995a, 1995b, 1996)); add to the fact that these NWFPs play a major role in the persistence of these rural people.

It seems that two main factors have contributed to the participation in the collection of these NWFPs in the study area, an internal factor and an external one.

The external factor originated outside the study area. It was generated by the increasing demand for the NWFPs in the major urban centers in Sudan, which has in turn stemmed from the increased variation of the uses of these products.

The internal factor arised from the fact that there was an increased deterioration and misuse of the natural resources resulting in drought and desertification which appeared in the disruption of the normal production cycles which had been prevailing in these fragile areas all these led to wide spread poverty among the inhabitants of these rural areas which forced them to seek further means to support their livelihood. To safeguard against further deterioration in these resources measures should be taken to insure the sustainability of these resources.

In addition to the above mentioned uses of the NWFPs by the households in the study area, from the results obtained, it could be said that, the surveyed households get use of the NWFPs found in their region in so many other ways. The respondents mentioned the recreation, shade for human beings and animals, site for children play times and shelter belts, as other forms of uses for the NWFPs in the study area.

To value the recreational services provided by the trees and forests in the study area the data obtained was found not to be applicable for such an analysis, so here the researcher just attempted to reflect some of the factors affecting the use of the provided recreational services. When analyzing the available data the results revealed that the independent variables together affected significantly the use of the recreational services provided by the resources available in the study area. When analyzing the effect of each variable alone, the position of the respondent in household and the respondents' village appeared to be the most effective factors on these uses i.e. it was evident that the dependent in the families and those from Um Higeiliga village use the recreational services more than the other members of these communities.

The results obtained from the respondents and confirmed by those from the group discussions and village leaders reflected that the collection of the NWFPs in the study area was faced by many problems. The far distances to these resources seemed to be the major constrain that facing the respondents in this region. Pests and diseases to which the resources were susceptible were mentioned. Also the thorns, difficulty of collection, shortage of the product and other forms of danger were problems mentioned by the respondents respectively. Another group of constraints were said to be found by small groups of the respondents also.

From the problems that facing the NWFPs activities in this region were those of marketing these products. Where the low prices and transportations to the markets were problems found to be dominant among the others, where the majority of the respondents referred to them. The prices fluctuation, fees, the shortage of product and low demand were constraints that prevailed in the study area as was perceived by another group of the respondents. Smaller number of the respondents said that the far distances to the markets, the competition on the market areas and the pests, respectively, are also among the problems that facing the marketing of the NWFPs in this region.

CHAPTER FOUR
RESULTS

Table 4.1 Summary of social characters of the respondents

Sex of respondents (percentage)						
	Male	female				
	36	64				
Age class of respondents (years)						
	Highest	Lowest	Mean	std .dev.		
range	40-45	80-85	44.2	13.74		
Frequency	47	2				
Family size (person / family)						
	Highest	Lowest	Mean	std . dev.		
	14	1	6	80.55		
Position in household (percentage)						
Heads of households		Dependent				
58		42				
Education level (% of total)						
Illiterate	khalwa	Primary	Secondary	University	Postgraduate	
53.7	7	29.1	9.5	0.7	0.0	
Marital status (% of total)						
	Single	Married	Divorced	Widow		
	17.5	75.4	3.9	3.2		
Main occupation (% of respondents)						
Farmer	Trader	Civil servant	Housewife	Unemployed	Other	
85	2.1	0.4	3.9	1.1	7.0	
Main source of income (% of respondents)						
Farming	NTFPs selling	Animal husbandry	Trading	Others		
44.6	13.4	10.8	4.9	26.3		
Income level (Ls000/year) (% of respondents)						
Low	Medium	High				
0-600	600-1600	1600-2000				
53.6	34.7	11.7				
Distribution of respondents according to their tribes (the largest three frequencies).						
Tribe	Bideria	Kenana	Tumam			
Frequency	98	25	25			
%	34.4	8.8	8.8			

4.2 Relationship between important social factors

Gender, Occupation and education

Descriptive analysis shows that although the number of females was greater than that of males, marital status is not significantly related to gender as indicated by the insignificant χ^2 value (Table 4.2). This is also true when the relationship between gender and educational level was investigated. Most of the population are illiterate regardless of gender (Table 4.3). More over division of heads of households into gender shows that females are also heads of households by a percentage quite near to that of males (Table 4.4).

Table 4.2 Frequency of respondents according to their gender and marital status

Marital status	Gender		Total
	Female	Male	
Single	33	17	50
Married	131	84	215
Divorce	10	1	11
Widow	8	1	9
Total	182	103	285

χ^2 = 6.829 at the level of significance 0.078

Table 4.3 Frequency of respondents according to their gender and education level

Education level	Gender		Total
	Female	Male	
Illiterate	87	66	153
Khalwa	10	10	20
Primary	72	11	83
Secondary	12	15	27
University graduate	1	1	2
Total	182	103	285

χ^2 = 5.35 at the level of significance 0.374

Table 4.4 Frequency of respondents according to their gender and position in household

Position in household	Gender				Total	
	Female	%	Male	%	Freq.	%
Household head	77	46.4	89	53.6	166	58
Dependent	105		14		119	42
Total	182		103		285	100

χ^2 = 52.599 at the level of significance .000

On the other hand the bulk of the Shiekan rural population are farmers regardless of gender as χ^2 statistics indicate that the relationship between gender and main occupation is not significant (Table 4.5). A similar result is obtained regarding the relation ship between education level and main occupation (Table 4.6), whether the respondent is illiterate or have attending school does not relate to the current main occupation. This means that the Shiekan rural community is a community where males and females are equally underprivileged regarding education and that almost half of the households are headed by females probably due to male migration to urban areas because of the meager opportunities in the province. It also means that the available employment opportunity for both males and females is farming as a main source of income. This is also signified by the fact that getting more years of schooling does not help in diversifying the main occupation.

Table 4.5 Frequency of respondents according to their gender and main occupation

Occupation	Gender		Total
	Female	Male	
Farmer	157	87	244
Trader	5	1	6
Employee	1	0	1
Housewife	6	5	11
Unemployed	3	0	3
Other	10	10	20
Total	182	103	285

χ^2 = 5.353 at the level of significance 0.374

Table 4.6 Frequency of respondents according to their education and main occupation

Occupation	Education level					Total
	Illiterate	Khalwa	Primary	Secondary	University	
Farmer	130	18	72	22	2	244
Trader	2	1	3	0	0	6
Employee	1	0	0	0	0	1
Housewife	3	1	3	4	0	11
Unemployed	2	0	1	0	0	3
Other	15	0	4	1	0	20
Total	153	20	83	27	2	285

$\chi^2 = 18.639$ at the probability level 0.545

4.3 Description of Socioeconomic factors related to NTFPs

4.3.1 Gender dimension (category of household member) in NTFPs collection

Relation between Gender (household member categories) and type and place of collection of NTFPs and distance traveled

Table 4.7 shows that fuel wood collection is concentrated in ghifar *land* thus representing the main source for fuel wood followed by family land. However, the place of collection is not significantly associated with gender categorization. This is also true for other NTFPs (Table 4.8) regarding their collection, but there is a clear association between the products and household categories collecting them (Table 4.9).

Table 4.7: Frequency of household member categories collecting fuel wood from different collection places

Household member Category	Collection place								
	Family land		Ghifar		Government land		Other		Total
	count	% of total	count	% of total	count	% of total	count	% of total	
Mother	88	38.4	110	48	14	6.1	17	7.4	229
Father	41	37.3	52	47.3	7	6.4	10	9.1	110
Children	44	35.2	57	45.6	10	8	14	11.2	125
Others	11	30.6	20	55.6	-	0	5	13.9	36
Total	184	36.8	239	47.8	31	6.1	46	9.2	500

χ^2 = 6.312at the probability level 0.708

Table 4.8: Frequency of household member categories collecting NTFPs from different collection places

Collection place	Household member Category				
	Mother	Father	Children	Others	Total
Family land	56	14	42	6	118
Ghifar land	118	35	75	9	237
Government land	8	2	8		18
Forest	38	11	38	6	93
Other	38	15	26	5	84
Total	258	77	189	26	550

χ^2 = 7.711 the probability level 0.807

Table 4.9: Frequency of household categories collecting different types of NWFPs

Product	Household member Category					
	Mother		Children		Father	
	Count	% Of total	Count	% Of total	Count	% Of total
Nabag	103	54.5	66	34.9	20	10.6
Gunglaize	11	19.3	33	57.9	13	22.8
Laloub	40	65.6	16	26.2	5	8.2
Sannamaka	31	75.6	8	19.5	2	4.9
Aradieb	31	64.6	11	22.9	6	12.5
Gudiem	20	50.0	9	22.5	11	27.5
Garad	27	61.4	7	15.9	10	22.7
Other	12	27.3	13	29.5	19	43.2
Total	275	52.5	163	31.1	86	16.4

χ^2 = 164.262 at the probability level 0.00

Distance traveled by household members to collect different NTFPs is illustrated in table 4.10. It was found that there is no significant association between the category member of households and the distance traveled in the case of family land where as there is a significant association in the case of *ghifar land,* and government land.

Table 4.10: Frequency of household member categories collecting NTFPs according to distance traveled to different collection places

Distance traveled/meters	Collection place																			
	Family land					Ghifar land					Government land					Other				
	Mother	*Father*	*Children*	*Others*	*Total*	*Mother*	*Father*	*Children*	*Others*	*Total*	*Mother*	*Father*	*Children*	*Others*	*Total*	*Mother*	*Father*	*Children*	*Others*	*Total*
≥1000	80	18	39	11	148	9	4	9	1	23	5	3	2		10	16	5	28	1	50
1000-3000	51	10	37	1	99	25	5	26	5	61	5		7		12	25	1	19	2	47
3000-5000	14	6	11	1	32	16	3	12		31		1	1	1	3	3	3		1	7
5000-7000	3	4	2		9	7		7		14	2				2	1	2			3
7000-9000	5	2	1		8		1			1									1	1
9000-11000	1				1	3	8	5		16		2			2	1	1	6	1	9
11000-13000						1				1										
13000≤							1			1						3				3
Total	154	40	90	13	297	61	22	59	6	148	12	6	10	1	29	49	12	53	6	120
χ^2 =	62.253 at sig. level of 0.206					=60.827 at sig. level of 0.014					30.998 at level of sig. 0.154					105.166 at level of sig. 0.00				

*Relation between Gender (*household member categories) *and time, duration and frequency of collecting NTFPs*

Table 4.11 below shows that there is no significant relation between categories of collectors and the time of the day when they collect. However, the bulk of collectors use the morning time (Figure 4.6). Concerning duration of collection there is a significant association with the category of members, although most of collectors would use 2-6 hours during the day in collection (table 4.12). The association of frequency of collection during the year and the member of household category is significant. While most fathers and children collect less than ten times a year, most mothers collect 1-20 times a year (table 4.13).

Table 4.11: Frequency of household categories and time of collecting NTFPs

Time of collection	Household member Category				
	Mother	Father	Children	Others	Total
Morning	213	52	155	20	440
Afternoon	33	16	20	4	73
Evening	8	6	11	2	27
All day	4	3	3		10
Total	258	77	189	26	550

χ^2 = 66.324 at the probability level 0.753

Table 4.12 Frequency of household categories and duration of collecting NTFPs

Duration (hours)	Household member Category				
	Mother	Father	Children	Others	Total
> 2	44	20	35	6	105
2-4	98	30	91	9	228
4-6	62	15	26	4	107
6-8	34	6	24	4	68
8-10	10	6	12	3	31
10-12	8				8
≤ 12	2		1		3
Total	258	77	189	26	550

χ^2 = 76.145 at the probability level 0.013

Table 4.13 Frequency of household categories and frequency of collecting NTFPs/ annually

Frequency of collection	Household member Category				
	Mother	Father	Children	Other	Total
1- 10	180	50	132	20	382
11 - 20	49	16	25	2	92
21 - 30	10	4	17	3	34
31 - 40	1	1			2
41 - 50	4		3	1	8
< 50	14	6	12		32
Total	258	77	189	26	550

χ^2 = 138.484 at the probability level 0.000

Relation between Gender (household member categories) and quantity of collected NTFPs

Table 4.14 shows that there is no association between household member categories and the quantity collected by each category. However, most collectors would collect more than 10 kgs regardless of gender.

Table 4.14 Frequency of household categories and quantity of collected NTFPs

Quantities collected (Kg)	Household member Category				
	Mother	Father	Children	Other	Total
>10	115	39	75	15	244
10 – 20	35	6	34	3	78
20 – 30	13	3	10	1	27
30 – 40	24	5	23	2	54
40 – 50	9	3	8	2	22
50 – 60	1	1	3		5
60 – 70	17	6	14	1	38
70 – 80	5				5
80 – 90					
≤90	39	14	22	2	77
Total	258	77	189	26	550

χ^2 = 16.5307 at the probability level 0.235

Gender dimension in utilization and marketing of collected NWFPs

Table 4.15 indicates that there is a significant association between gender and type of use of products. Children mainly use Nabag while everyone in the household uses *Gunglaize* and *Aradieb*. Expectantly, *Subag* and *Talih* are used only by women as they are cosmetic wood. On the other hand Figure (4.1) shows that in most households mothers are the ones who market the collected NTFPs although the income is not received by them in all cases. This is also true for the other categories. This is because although household members carry out marketing individually, on average the household shares the revenue collectively. Most of respondents would sell at the village market or in the larger markets of Elobied and Khazgeil, regardless of the member category of the household (table 4.16)

Table 4.15: Frequency of household member categories utilizing collected NWFPs

Type of NTFPs	Household member category			
	Mother	Father	children	All the family
Nabag	43	42	70	71
Gunglaize	30	24	8	78
Laloub	12	10	14	22
Sannamaka	13	12	6	11
Aradieb	19	17	13	63
Gudiem	20	14	11	49
Garad	18	20	19	33
Talih	40	-	-	-
Subag	20	-	-	1
Gebiesh	14	16	4	16
* Other	33	42	24	88
Total	262	197	169	432

$\chi^2 = 689.569$ at the probability level .000

*other: include respondents using various types of NWFPs from various species.

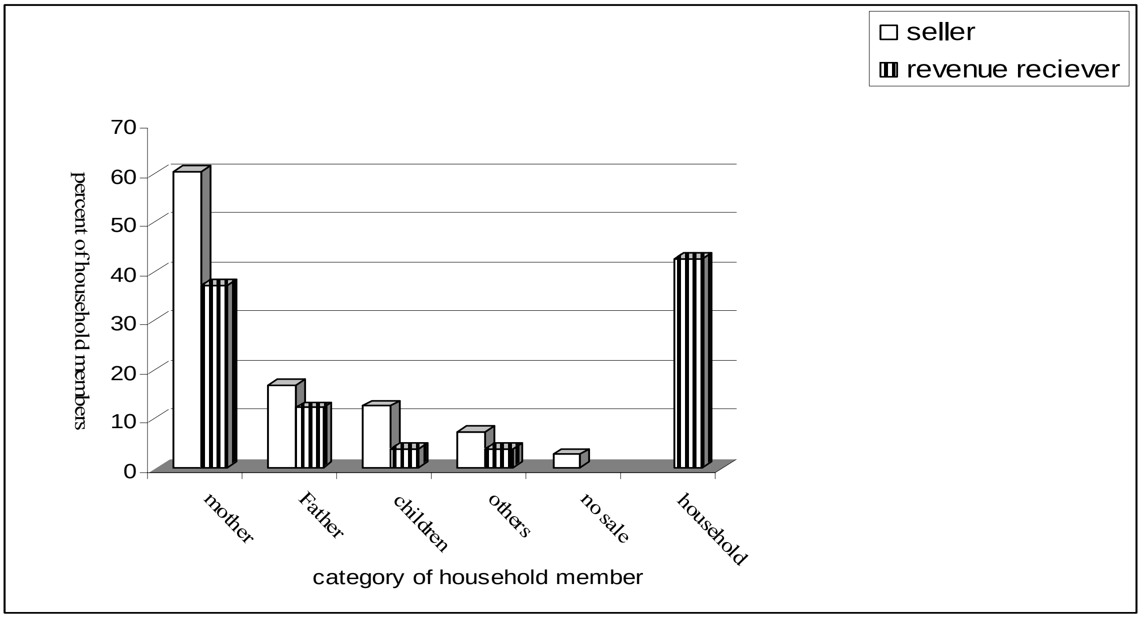


Figure 4.1: Frequency (%) of household members marketing NWFPs and receiving sale revenue.

Table 4.16: Relationship between place of marketing NWFPs and the household member category selling them

Market	Frequency of families according to the markets for selling NTFPs by				
	Mother	Father	Children	Other	Total
Village market	53	19	42	5	119
Elobied	56	21	45	4	126
Khazgeil	30	11	19	7	67
Abugau'd	5	2	2		9
Abukindi	28	4	8	4	44
Albirka	2				2
Alouba	9	3	15		27
Abuharaz	8	4	7	2	21
Altina	2				2
Umramad	8	1	3		12
Rakunna	3	2	2	2	9
Village kintien	25	3	23	1	52
Total	229	70	166	25	490

$\chi^2 = 46.538$ at significance level 0.112

4.3.2 Perceived benefits, types, sites and sources of NTFPs

Table (4.17) indicates that respondents perceive various benefits for the NTFPs in the study area, ranging from direct benefits perceived by the majority of respondents such as food, traditional medicine and income generation; to indirect benefits (perceived by fewer respondents) such as increasing soil fertility and climatic amelioration.

Regarding the different types of NTFPs, all respondents[1] use fuel wood as the sole source of energy for cooking or tea and coffee making: either in the form of firewood (84% of respondents) or as charcoal (17% of respondents) as is shown in Table 4.18 χ^2 test indicate that there is a significant relationship between the type of fuel used and the kind of use i.e. fuel wood is the main fuel for cooking while charcoal is the main one for tea and coffee making. Table (4.19) indicate that most households collect fallen fuel wood (54.4%) while 23.1% cut lower branches and the rest either buy from the market (17.9%) or from other sources.

Table 4.17: Distribution of households according to their perceived benefits of NTFPs in Shiekan Province

Perceived benefits	Frequency	%
Food	130	16.5
Traditional medicine	109	13.9
Fuel	104	13.2
Income	98	12.5
Combat desertification	94	12.0
Shade	64	8.1
Belts for farms	43	5.5
Fodder	42	5.3
Increase soil fertility	29	3.7
Used by women when giving birth	22	2.8
Used in ceremonies (branches)	19	2.4
Bring rain	18	2.3
Funerals washing	7	0.9
Climate amelioration	5	0.64
Connected with bad spirits	2	0.25
Total	786	100

1- except one person who stated that he uses LPG

Table 4.18: Frequency of families according to the type of fuel they use & the purposes of the use

Purpose	Type of fuel					
	Charcoal		firewood		Gas	
	Count	% (of total)	Count	% (of total)	Count	% (of total)
Cooking	50	17	244	84	1	.3
Tea and coffee making	142	49	15	5	-	-
All types	12	4	12	4	-	-

$\chi^2 = 226.6$ at a probability value of (0.00)

Table 4.19: Frequency of families according to their ways for getting charcoal and fuel wood

Ways of collection	Number of families	%
Falls collection	259	54.4
Cutting the lower parts	110	23.1
Market	85	17.9
Others	22	4.6
Total	476	100

NTFPs other than fuel wood are found in these rural areas as was mentioned by the respondents. The surveyed households in the 27 villages of the study area commonly gather and use thirty-four (34) types (Appendix, 2). But when going through these species thoroughly, it was evident that these products vary with the number of households according to the types mostly extracted and dealt with. Of these the most important ones according to the size of population engaged in collecting it is, *Nabag* (the product of *Zizyphus spina-cristi)* where about 67% of the respondents collect it. This was followed, in descending rate, by *laloub (*the product of *Balanites aegyptiaca)* where about 20% of the respondents collect it, *Gunglaize* (the product of *Adansonia digitata)* where about 17% of the respondents collect it, *Aradieb* (the product of *Tamarindus indica)* where about 16.8% of the respondents collect it. Of less importance are *Garad,* (the product of *Acacia nilotica*) *Gudiem,* (the product of *Grewia tanex) and Sannamakka,* (the product of *Cassia senna)* (Figure 4.2).

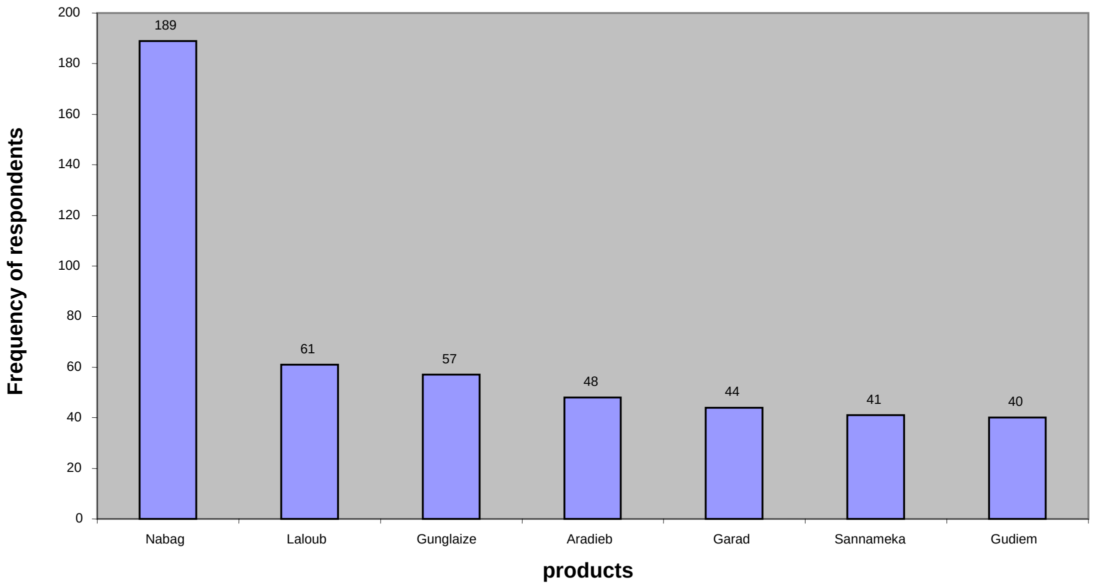


Figure 4.2: Frequency of respondents according to the NTFPs they collect

It was also found that most respondents would be engaged in the collection of one or two products, fewer respondents would collect more types of products (Figure 4.3). The sources (trees, shrubs or grasses) from where NTFPs are collected vary. Most of the products are obtained from trees. The same products are also obtained from shrubs but at a lower frequency (Figure 4.4). Figure 4.5 indicates that most respondents collect NTFPs either from their own land (family land) or from *ghifar* (communal land), other places of collection include forests and "government land".

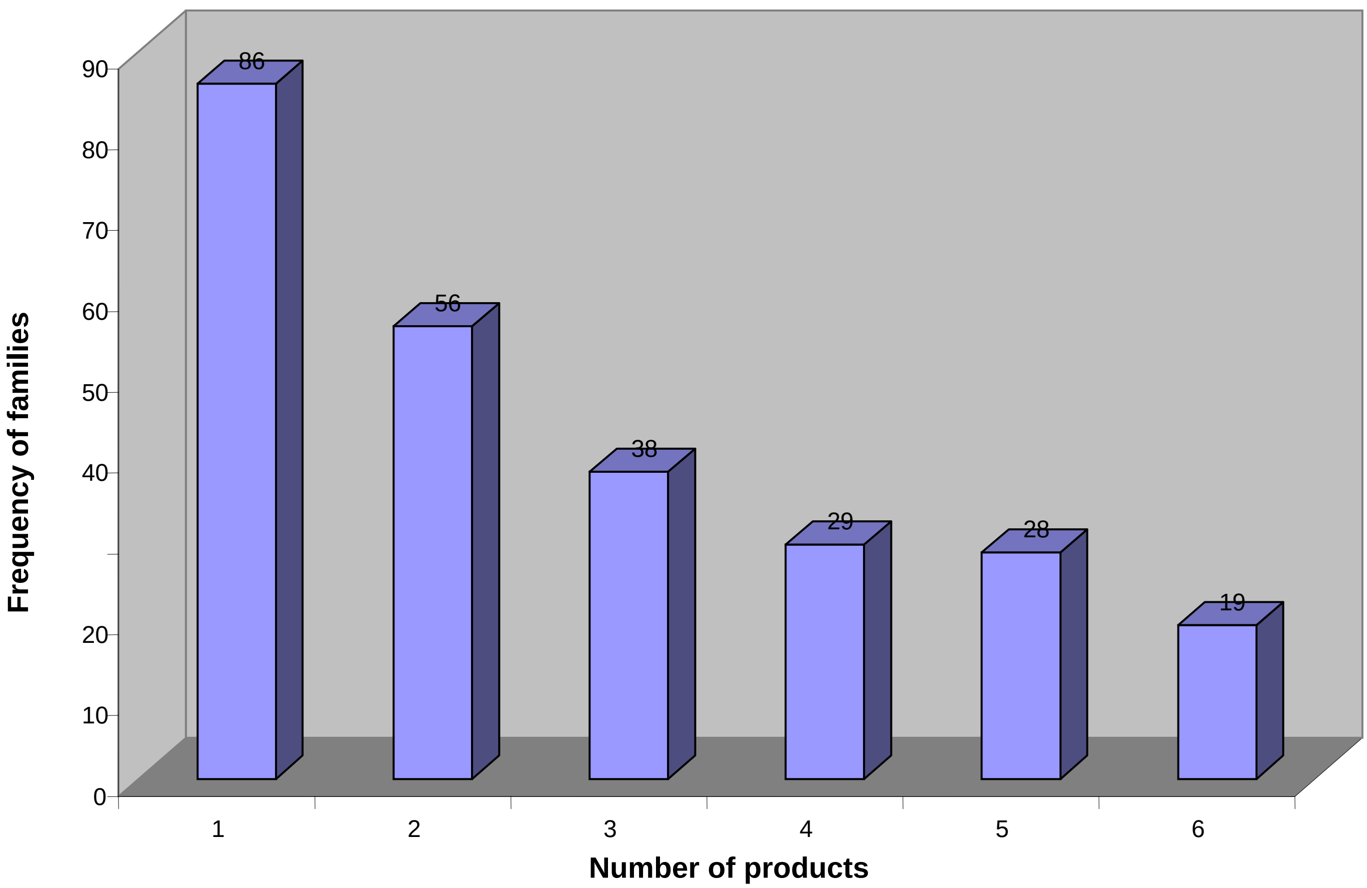


Figure 4.3 Frequency of respondents according to the number of NTFPs collected in Shiekan Province

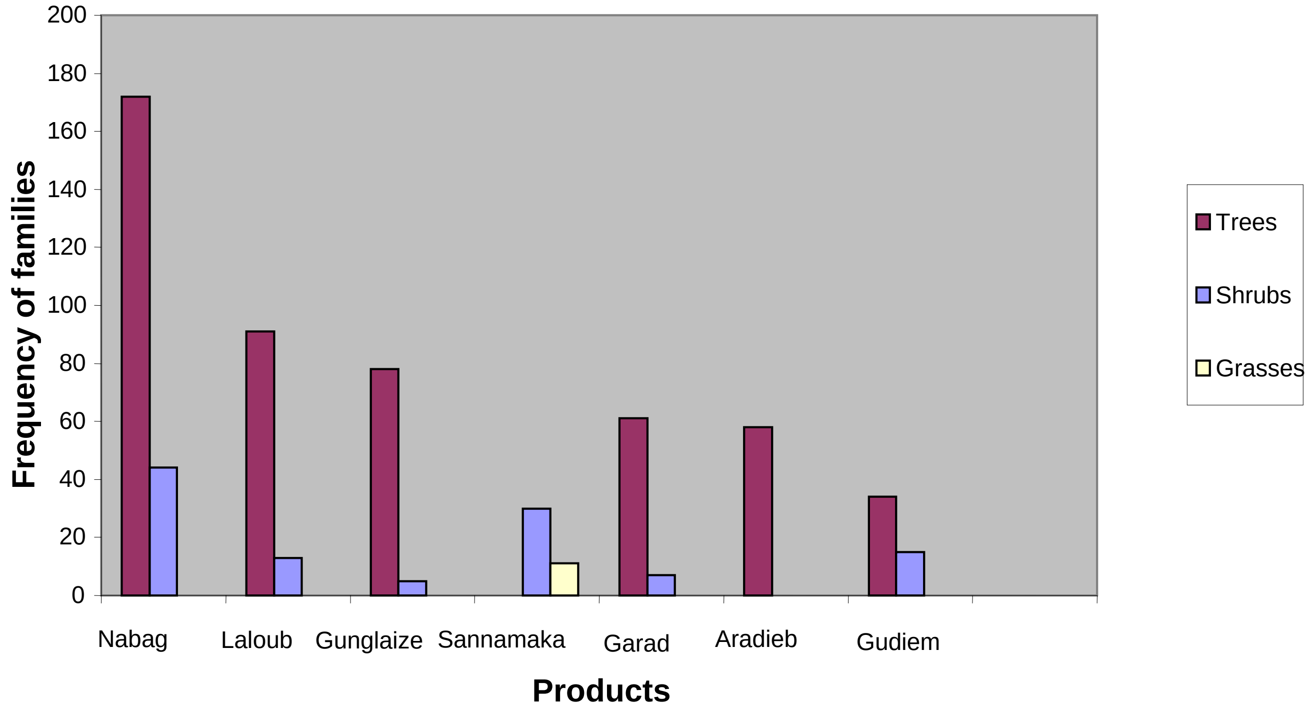


Figure 4.4 Frequency of respondents according to the sources of NTFPs collected in Shiekan Province

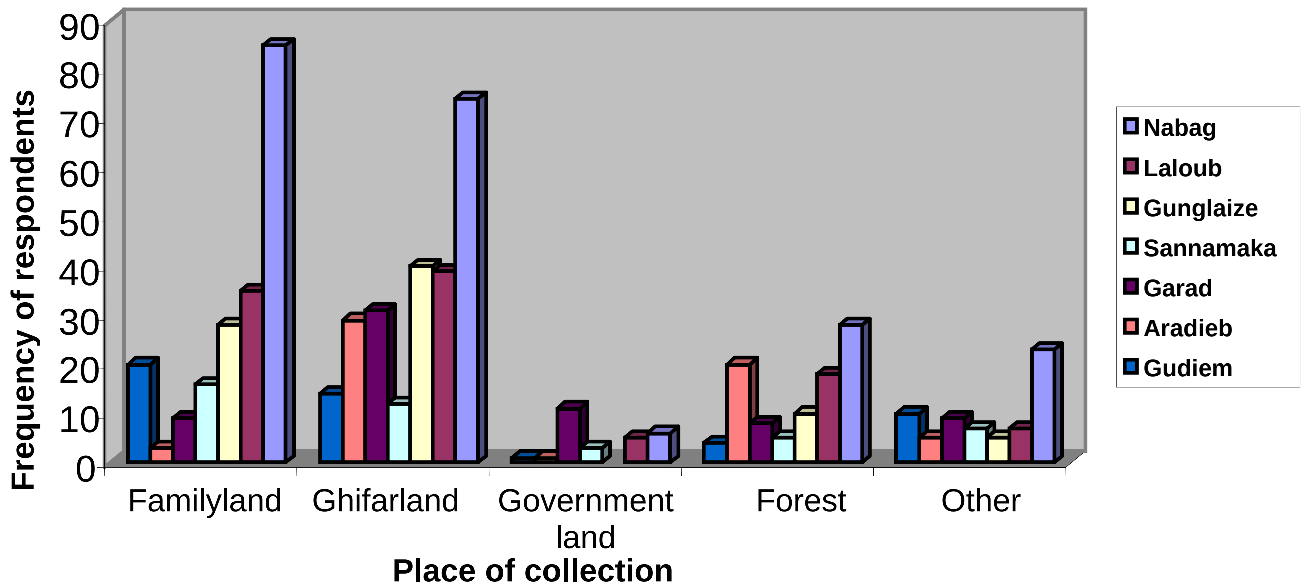


Figure 4.5 Frequency of respondents according to the sites of collecting the NTFPs in Shiekan Province

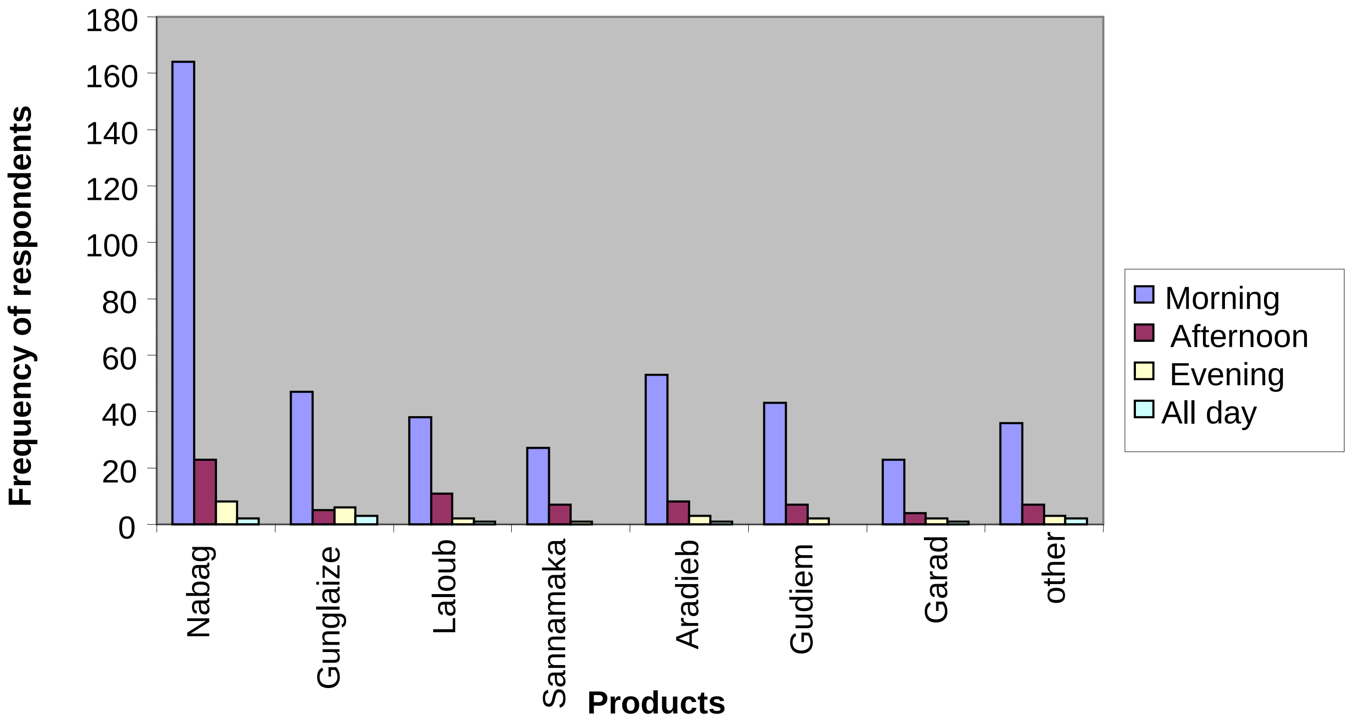


Figure 4.6 Frequency of respondents according to the time of the day during which NTFPs are collected

4.3.3 Distance traveled and pattern of collecting NTFPs

Households members travel different distances to collect NTFPs. Most respondents would walk a distance from 1000 to 3000 meters. The shortest distance is 200 meters when collecting from family land, 250 when from *ghifarland* and a little more than 2000 when collecting from government land. Table 4.20 gives more detailed information. Most households collect in the morning regardless of the type of NTFPs they are collecting (Figure 4.6).

Table 4.20: Relationship between distances traveled to collect NTFPs and place of collection

Distance (meter)	Family land	Gifarland	Government	Other
>1000	148	23	10	50
1000-3000	99	61	12	47
3000-5000	32	31	3	7
5000-7000	9	14	2	3
7000-9000	8	1	-	1
9000-11000	1	16	2	9
11000-13000		1		
< 13000		1		3
Total	297	148	29	120
Mean Distance	1411.95	3239.87	2124.14	2581.46
St- deviation	1609.63	3681.85	2537.49	5069.57
Least Distance	200	250	100	250
Max. Distance	10000	30000	10000	30000

Mean duration of collection is about three hours a day (table 4. 21). The frequency of collection during the year is 1- 10 times annually for most respondents for all products (Figure 4.7). The season of collection for all products is the dry season; few people would collect during the wet season (Figure 4.8).

Table 4.21: Frequency of families according to the duration (in hours) of collection of NTFPs

Time (hours)	Frequency of families	%
> 2	105	19.1
2-4	228	41.5
4-6	107	19.5
6-8	68	12.4
8-10	31	5.6
10-12	11	2.0
Total	550	100
Least time	0.25	
Max. time	12	
Mean	3.53	

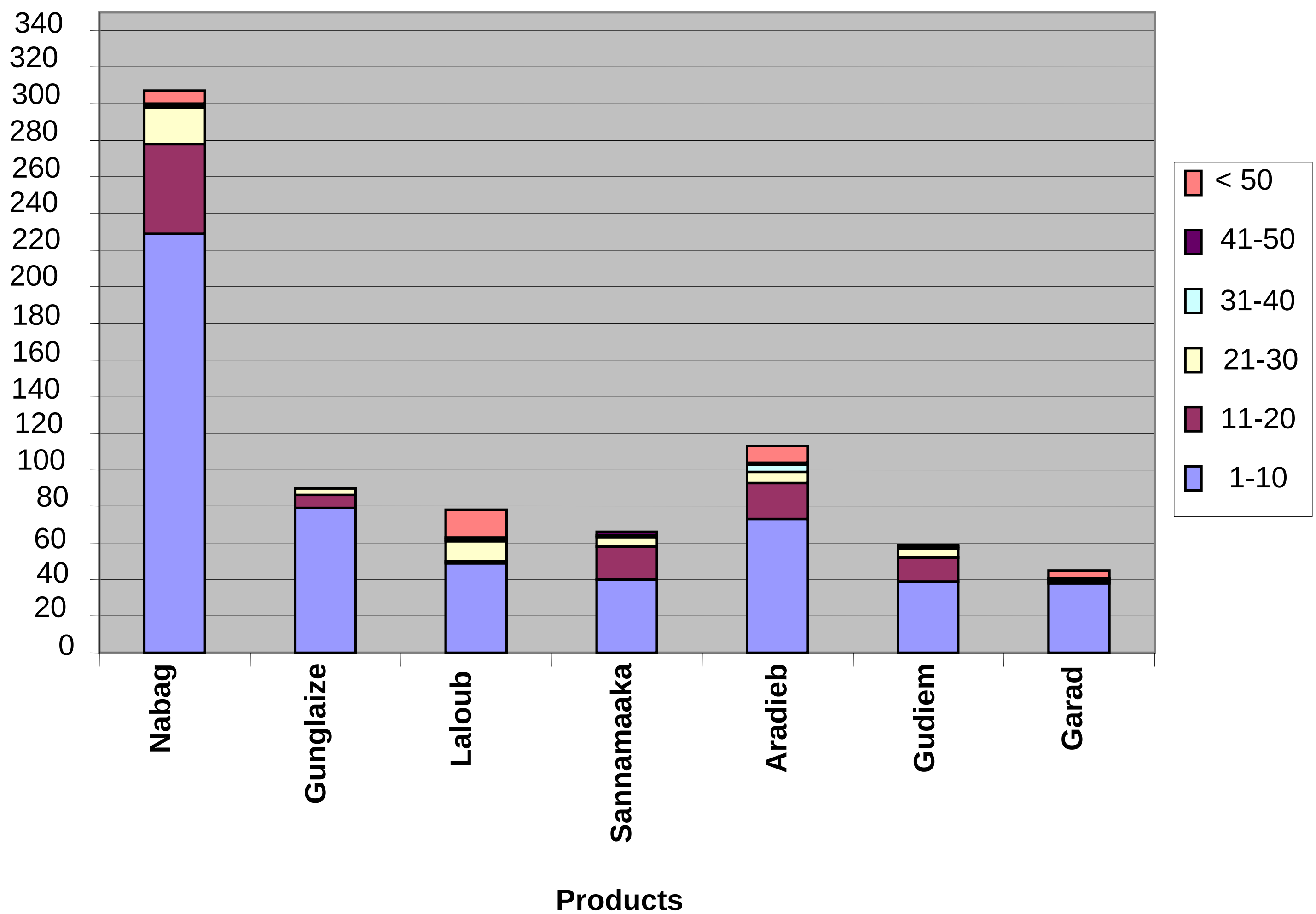


Figure 4.7: Number of families according to the frequency of collecting NTFPs /annually

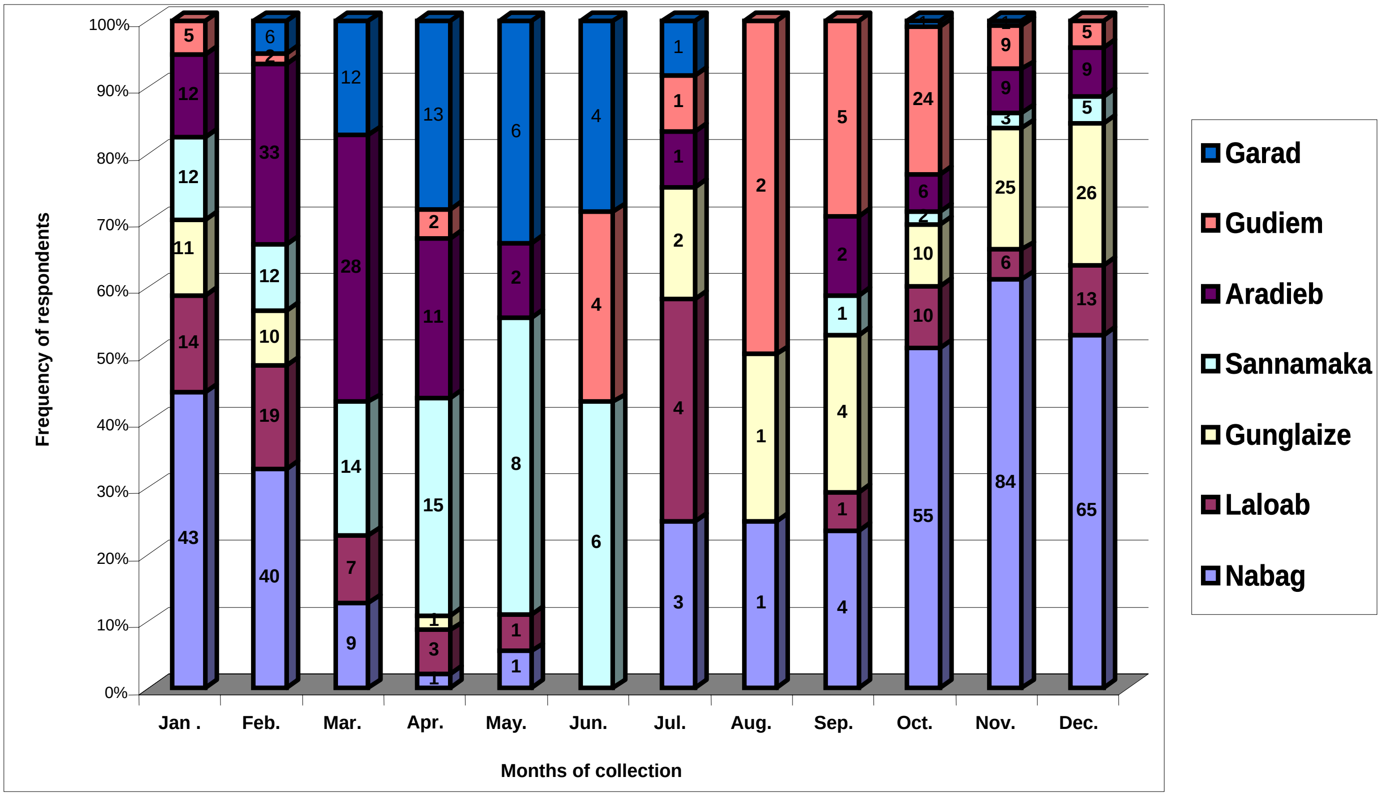


Figure 4.8: Number of families according to the product & its time of collection

4.3.4 Methods of harvest and product treatment

Different modes of harvesting NTFPs are practiced. While *Nabag* is simply collected from the ground by most respondents, sticks are also used. Traditional tools such as *gubada* or *muhgam* is used mostly by those collecting *Aradieb* and *Gunglaize*. Hands are used exclusively when collecting *Sannamaka* as the source is shrub with no thorns or other sharp parts. Figure 4.9 gives details of different harvesting methods.

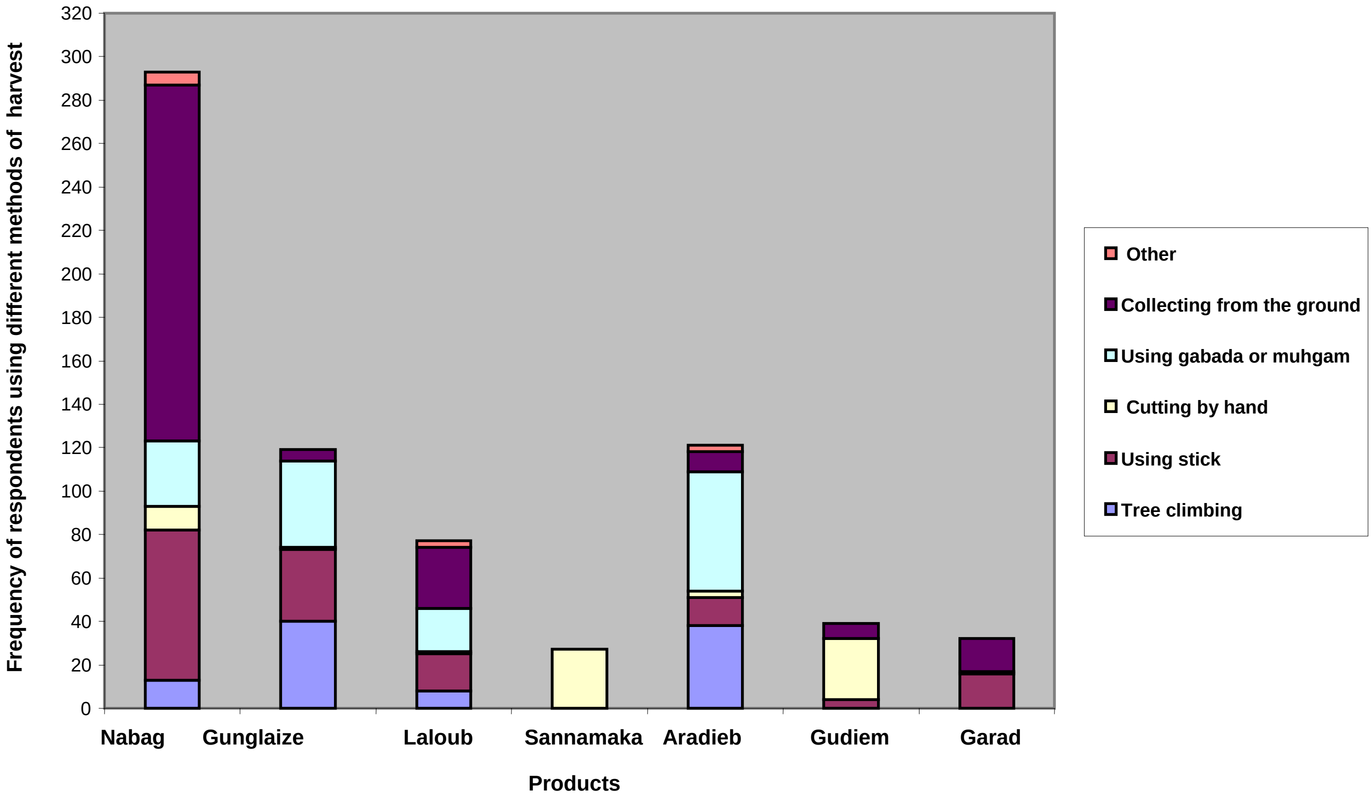


Figure 4.9 Frequency of families using different methods of harvesting NTFPs in Shiekan province

Respondents who subject NTFPs to post-harvest treatment mentioned different types of treatment to different products. The χ^2 statistics indicates a significant relationship between the type of product and type of treatment. Most respondents will only sort out products, except for *Aradieb* where chipping seems to be an important treatment (Table 4.22).

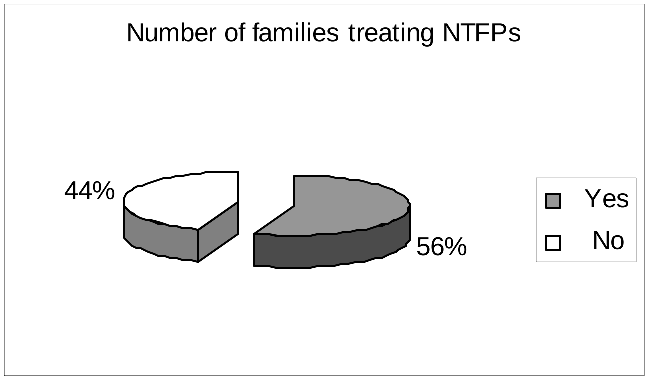


Figure 4.10 Frequency of families according to whether they subject NTFPs to post harvest treatment

Table 4.22: Frequency of families according to the type of treatment to NTFPs

Type of NTFPs	Distribution of families according to the type of treatment				
	Sorting	Grading	Chipping	Drying	Other
Nabag	54	-	11	10	-
Gunglaize	10	1	10	-	-
Laloub	7	1	-	7	1
Sannamaka	5	-	-	13	-
Aradieb	6	1	41	-	1
Gudiem	10	-	-	2	-
Garad	7	-	-	-	-
Kawal	-	-	-	-	2
Mirik	-	-	-	-	1
Abanos	1	-	-	1	-
Total	100	3	62	33	5

$\chi^2 = 210.015$ at a probability value of (0.00)

The reasons why products were treated were also given. Reasons differ as products differ (indicated by a significant relation). For the *Nabag* product market demand and insect infestation was the main reason. For the other products market demand was the main reason behind treatment (Table 4.23)

Table 4.23: Frequency of families according to the type of product & the reasons of post-harvest treatment of NTFPs.

Product	Distribution of families according to the reasons for treatment			
	Market demand	Infection by Insects & pests	Cleaning	Reducing Weight
Nabag	48	25	2	-
Gunglaize	16	3	-	2
Laloub	15	-	1	-
Sannamaka	16	1	1	-
Aradieb	46	2	1	-
Gudiem	10	1	1	-
Garad	4	-	3	-
Kawal	-	2	1	-
Mirik	-	-	-	-
Abanos	2	-	-	-
Total	157	34	10	2

χ^2 = 194.692 at a probability value of (0.00)

4.3.5 Utilization of NTFPs

Respondents of Shiekan province put NTFPs to diverse uses as it is evident from Figure 4.11 *Nabag* is mostly used as food while *Gunglaize, Aradieb and Garad* are mostly used as drinks. The next most important use is medicinal use.

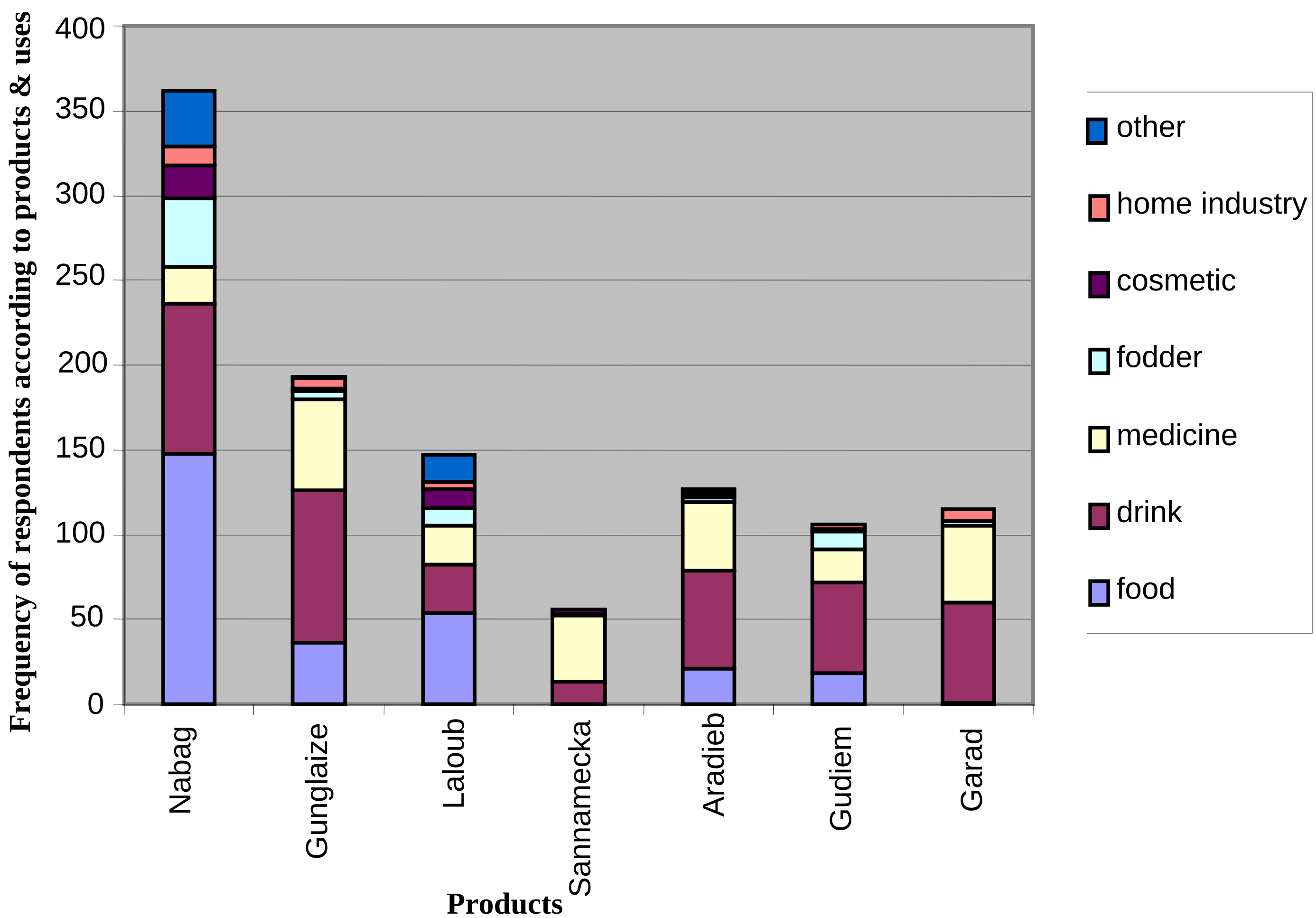


Figure 4.11 Frequency of respondents according to the products & their uses

Table 4.24 shows the season of using NTFPs. The χ^2 statistics shows the significant relation between the type of product and season of use. For *Nabag,* it is mostly used during the rainy season, agricultural crop harvesting season and during drought spells. On the other hand, *Gunglaize, Aradieb and Gudeim* are used mostly during the fasting season (*Ramadan*) but also whenever needed. Table 4.24 also indicates the most important products with respect to the frequency of users. As such *Nabag*, *Gunglaize*, *Gudeim,* *Aradieb and Laloub* are the most important and will therefore be further analyzed in the following sections.

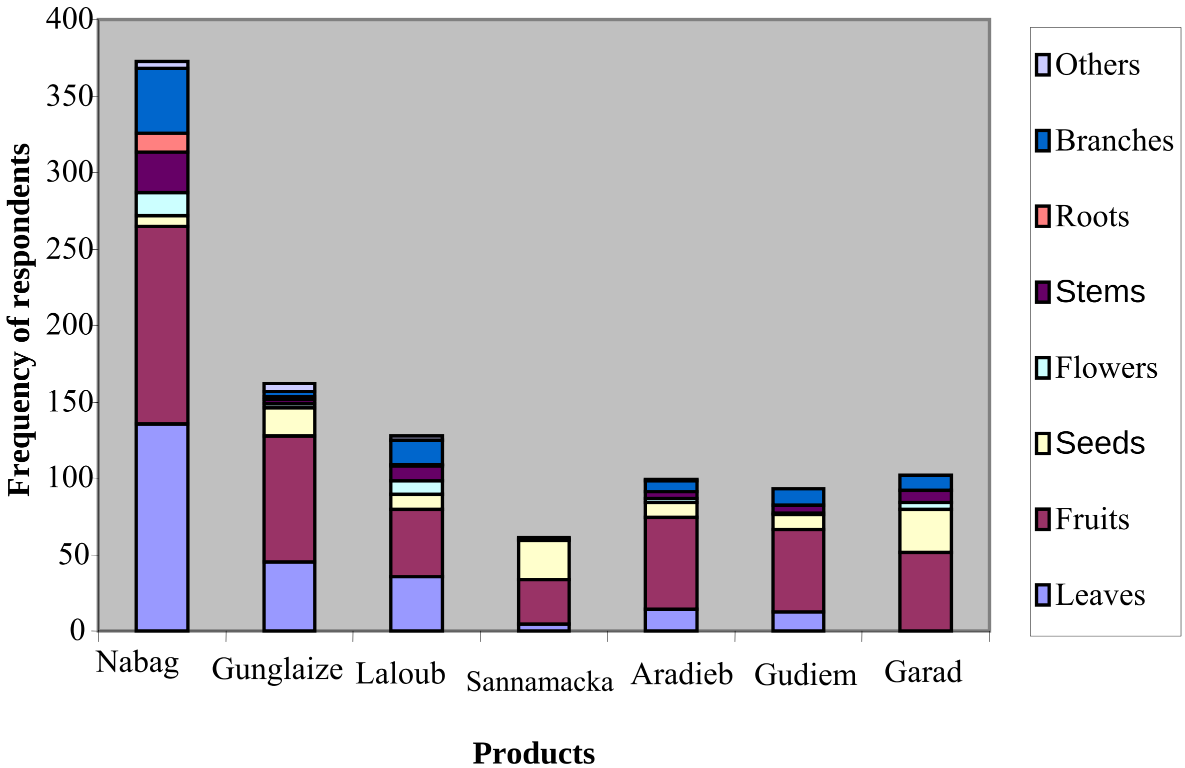


Figure 4.12: Frequency of respondents according to the products and parts use

Table 4.24: Frequency of respondents according to product & its time of use

Product	Frequency of families according to the periods of uses										
	Rainy season	Harvest	Drought	Giving birth	Ramadan	On Need	Off season	Summer	Winter	All times	Total
Nabag	40	71	26	7	5	23	5	18	1	20	216
Gunglaize	2			14	58	32		1		5	112
Gudiem					37	36		1		6	80
Aradieb	2	1	3	2	43	25				2	78
Laloub	6	8	4	6	14	4	1	2	1	8	54
Neem	6									7	13
Garad			2	3					2	1	8
Mirik		2				4				2	8
Usher	3	3								-	6
Gebiesh						5				1	6
Talih						3				3	6
Sayal			1			1		3		-	5
Kitir								2		2	4
Gatgat						4				-	4
Gatgat						4				-	4
Kawal						2				1	3
Sannameka					1					2	3
La'out								3		-	3
Karoum								2		-	2
Haraz								2		-	2
Subag										2	2
Habeel										2	2
Helaw					2					-	2

χ^2=1478.76 at a probability value of (0.00)

4.3.6 Relationship between Collected and consumed quantities of NTFPs and socioeconomic factors

Tables 4.25 depict the mean quantity of NTFPs collected and mean quantities consumed by the household. It is obvious that, on average all households consume some of the collected products, although the consumed quantity is a small portion of the collected quantity.

Table 4.25 Annual collected and consumed mean quantities of important NTFPs in Shiekan province (Kg/household)

Products	N	Quantities (Kg)			
		Collected	Sd	Consumed	Sd
Nabag	189	51.62	144.77	16.97	22.23
Gunglaize	57	72.37	95.19	16.10	17.72
Laloub	61	101.82	239.59	12.65	17.79
Sannamaka	41	300.65	915.28	178.41	409.50
Aradieb	48	81.99	155.51	11.33	12.58
Gudiem	40	13.72	22.69	3.58	4.56
Garad	44	330.84	394.25	29.15	54.71

Analysis of variance (Tables 4.26 &Table 4.27) indicate that differences in the mean quantities collected by households in the different administrative units (Um Eishiera & Tagat, Kazgail and Abu Haraz) are significant only in the case of *Gunglaize* and *Laloub*. For *Gunglaize* the highest collected quantity was in Kazgail, while for *Laloub* it was in Um-Eishera Unit.

Tables 4.28 depict the mean quantity of NTFPs collected by the different age groups of respondents at the household level. Analysis of variance (table 4.29) indicates that the mean quantities of all NTFPs are not significantly different among age groups. When considering gender, the quantities collected are not significantly different due to gender except in the case of *Aradieb* and *Gudiem* where the quantities collected by males were significantly smaller than that collected by females for both products (tables 4.30 and 4.31).

Table 4.26: Mean Quantity (Kg/household) of the major NTFPs collected by the respondents in the three administrative units of Shiekan Province

Product	Administrative Unit					
	Um-Eishera N = 124		Kazgail N =80		Abu-Haraz N = 81	
	Mean	Sd[1]	Mean	Sd	Mean	Sd
Nabag	34.27	84.48	33.75	85.52	34.83	121.99
Gunglaize	10.36	28.34	26.41	74.01	9.01	34.21
Laloub	42.55	170.02	5.07	15.60	6.53	8.02
Sannamaka	35.46	125.04	74.40	581.71	24. 43	48.75
Aradieb	14.95	49.71	20.22	112.33	5.73	34.54
Gudiem	2.73	12.63	1.55	6.02	1.07	5.80
Garad	80.75	20.5.52	34.5	33.67	14.37	1.24

Sd[1] = standard deviation

Table 4.27: Analysis of variance for the Mean Quantity (Kg/household) of the major NTFPs collected by the respondents in the three administrative units of Shiekan Province

Product	Source of variation	DF	SS	MS	Calculated F	Sig.
	Between Localities	2	64.10	32.05	0.003	0.997
Nabag	Within Localities	282	2646139.6	9383.47		
	Total	284	2646203.7			
	Between Localities	2	20945.48	10472.74	4.59*	0.01
Gunglaize	Within Localities	282	642926.16	2279.88		
	Total	284	663871.64			
	Between Localities	2	108541.82	54270.91	4.28*	0.02
Laloub	Within Localities	282	3578679.7	12690.35		
	Total	284	3687221.5			
	Between Localities	2	176895.12	88447.56	0.85	0.43
Sannamaka	Within Localities	282	29268310.	103788.33		
	Total	284	29445205.			
	Between Localities	2	8738.24	4369.12	0.88	0.42
Aradieb	Within Localities	282	1396245.7	4951.23		
	Total	284	1404983.9			
	Between Localities	2	182.23	91.12	1.03	0.40
Gudiem	Within Localities	282	25063.39	88.88		
	Total	284	25245.62			
	Between Localities	2	201178.63	100589.32	5.37*	0.01
Garad	Within Localities	282	5285068.9	18741.38		
	Total	284	5486247.5			

(*) indicates significant differences at the (0.05) level.

Table 4.28: Mean Quantity (Kg/household) of the major NTFPs collected by the respondents at different age groups.

Product	Age group of respondents							
	< 20 years N=2		20-40 N=100		40-60 N=127		>60 years N=56	
	Mean	Sd	Mean	Sd	Mean	Sd	Mean	Sd
Nabag	2.50	3.54	30.05	80.19	45.24	124.09	17.88	25.35
Gunglaize	0.00	0.00	11.85	33.12	15.44	56.55	17.50	51.62
Laloub	0.00	0.00	10.48	65.31	28.99	160.82	8.59	27.87
Sannamaka	7.50	10.61	19.12	40.15	65.38	68.41	37.45	732.75
Aradieb	5.00	7.07	9.19	28.98	17.83	95.41	13.25	55.66
Gudiem	0.00	0.00	1.74	7.31	1.84	6.74	2.54	16.06
Garad	0.00	0.00	14.57	78.10	29.75	144.57	36.44	201.21

Table 4.29: Analysis of variance for the Mean Quantity (Kg/household) of the major NTFPs collected by the respondents at different age groups

Product	Source of variation	DF	SS	MS	Calculated F	Sig.
	Between Age Groups	3	341108.07	11369.36	1.22	0.30
Nabag	Within Age Groups	281	2612095.66	9295.71		
	Total	284	2646203.73			
	Between Age Groups	3	5756.73	1918.91	0.82	0.48
Gunglaize	Within Age Groups	281	658114.06	2342.04		
	Total	284	663870.79			
	Between Age Groups	3	19647.48	6539.86	0.50	0.68
Laloub	Within Age Groups	281	3667574.06	13051.96		
	Total	284	3687221.54			
	Between Age Groups	3	543587.12	181195.71	1.76	0.16
Sannamaka	Within Age Groups	281	28901618.10	102852.73		
	Total	284	29445205.22			
	Between Age Groups	3	4360.05	1453.35	0.29	0.83
Aradieb	Within Age Groups	281	1400623.94	4984.43		
	Total	284	1404983.99			
	Between Age Groups	3	40.53	13.51	0.15	0.93
Gudiem	Within Age Groups	281	25205.09	89.70		
	Total	284	25245.62			
	Between Age Groups	3	22099.13	7366.38	0.38	0.77
Garad	Within Age Groups	281	5464148.44	19445.37		
	Total	284	5486247.57			

Table 4.30 Mean Quantity (Kg/household) of the major NTFPs collected by the respondents separated by gender

Product	Gender			
	Males N = 103		Females N = 182	
	Mean	Sd	Mean	Sd
Nabag	37.84	75.94	32.19	106.57
Gunglaize	7.79	32.69	18.26	45.13
Laloub	26.32	105.11	19.23	111.58
Sannamaka	18.20	69.59	57.43	399.63
Aradieb	6.93	38.25	17.70	83.04
Gudiem	0.81	2.09	2.56	11.64
Garad	47.23	115.12	53.25	131.20

Table 4.31: ANOVA for the Mean quantity (Kg/household) of the major NTFPs collected by the respondents separated by gender

Products	Source of variation	DF	SS	MS	Calculated F	Sig.
Nabag	Between sex groups	1	2103.51	2103.51	0.23	0.64
	Within sex groups	283	2644100.	9343.11		
	Total	284	2646203.			
Gunglaize	Between sex groups	1	4101.13	4101.13	1.73	0.19
	Within sex groups	283	659769.6	2331.34		
	Total	284	663870.7			
Laloub	Between sex groups	1	671.15	671.15	0.05	0.82
	Within sex groups	283	3686550.	13026.68		
	Total	284	3687221.			
Sannamaka	Between sex groups	1	44405.45	44405.45	0.43	0.51
	Within sex groups	283	29400799	103889.75		
	Total	284	29445205			
Aradieb	Between sex groups	1	7618.55	7618.55	1.54	0.22
	Within sex groups	283	1397365.	4937.69		
	Total	284	1404983.			
Gudiem	Between sex groups	1	262.95	262.95	2.98	0.09
	Within sex groups	283	24982.67	88.28		
	Total	284	25245.62			
Garad	Between sex groups	1	612.72	612.72	0.03	0.87
	Within sex groups	283	5485634.	19383.87		
	Total	284	5486247.			

The social factor of the collector being a head of the household or a dependent was also considered. It was found that the mean quantities collected do not vary significantly between these two groups (Table 4.32 and 4.33). As regard to the effect of marital status of collectors the mean quantities collected do not vary significantly between married and unmarried groups (Tables 4.34 & 4.35). The mean quantities collected were not significantly affected by the education level of respondents except in the case of Sannamaka, where those with *khalwa* education level seem to collect higher quantities than other groups (tables 4.36 &4.37).

Table 4.32: Mean quantity (Kg/household) of the major NTFPs collected by the respondents according to position of collector in the household

Product	Household head N = 165		Dependent N = 120	
	Mean	Sd	Mean	Sd
Nabag	40.50	110.40	26.34	73.00
Gunglaize	10.41	45.96	20.06	45.32
Laloub	26.94	146.79	14.72	41.12
Sannamaka	29.64	41.17	61.97	490.78
Aradieb	14.20	49.34	13.28	91.93
Gudiem	1.34	5.94	2.73	12.75
Garad	54.25	162.15	46.71	95.74

Table 4.33: ANOVA for Mean quantity (Kg/household) of major NTFPs collected by respondents separated by position in household

Products	Source of variation	DF	SS	MS	Calculated F	Sig.
Nabag	Between Respondents	1	13251.64	13251.64	1.42	0.23
	Within Respondents	283	263295.09	9303.78		
	Total	284	2646203.73			
Gunglaize	Between Respondents	1	2315.41	2232.67	0.96	0.33
	Within Respondents	283	661555.38	2337.94		
	Total	284	663870.79			
Laloub	Between Respondents	1	16966.28	16966.28	1.31	0.25
	Within Respondents	283	3670255.26	12969.10		
	Total	284	3687221.54			
Sannamaka	Between Respondents	1	152785.81	152785.81	1.48	0.23
	Within Respondents	283	29292419.40	103506.78		
	Total	284	29445205.21			
Aradieb	Between Respondents	1	59.25	59.25	0.01	0.91
	Within Respondents	283	1404924.74	4964.40		
	Total	284	1404983.99			
Gudiem	Between Respondents	1	97.47	97.47	1.10	0.30
	Within Respondents	283	25148.16	88.86		
	Total	284	25245.62			
Garad	Between Respondents	1	715.13	715.13	0.04	0.85
	Within Respondents	283	5485532.45	19383.51		
	Total	284	5486247.58			

Table 4.34: Mean Quantity (Kg/household) of the major NTFPs collected by the respondents according to their marital status.

Product	Marital Status							
	Single N= 50		Married N= 215		Divorce N= 11		Widow N= 9	
	Mean	Sd	Mean	Sd	Mean	Sd	Mean	Sd
Nabag	16.98	29.84	39.82	109.40	22.55	35.47	11.00	10.82
Gunglaize	8.46	28.43	16.87	53.71	6.82	18.20	0.00	0.00
Laloub	18.24	41.51	24.06	117.41	0.00	0.00	14.15	72.13
Sannamaka	24.31	54.74	51.57	217.14	0.00	0.00	2.78	8.33
Aradieb	14.22	39.56	14.93	78.67	1.36	3.23	0.00	0.00
Gudiem	1.21	6.31	2.11	10.37	1.27	3.13	2.22	0.00
Garad	44.13	112.41	57.26	153.31	0.00	0.00	4.41	0.00

Table 4.35: Analysis of variance for the Mean Quantity (Kg/household) of the major NTFPs collected by the respondents separated by marital status.

Product	Source of variation	DF	SS	MS	Calculated F	Sig.
Nabag	Between Respondents	3	27946.03	9315.34	1.00	0.93
	Within Respondents	281	2618257.70	9317.64		
	Total	284	2646203.73			
Gunglaize	Between Respondents	3	3539.31	1179.77	0.50	0.68
	Within Respondents	281	660331.48	2349.93		
	Total	284	663870.79			
Laloub	Between Respondents	3	26512.41	8819.92	0.68	0.57
	Within Respondents	281	3660709.13	13027.63		
	Total	284	3687221.54			
Sannamaka	Between Respondents	3	48715.41	16238.47	0.16	0.93
	Within Respondents	281	29396489.80	104613.84		
	Total	284	29445205.21			
Aradieb	Between Respondents	3	3698.13	1232.71	0.25	0.86
	Within Respondents	281	1404285.86	4986.78		
	Total	284	1404983.99			
Gudiem	Between Respondents	3	29.73	9.91	0.11	0.95
	Within Respondents	281	25215.90	89.74		
	Total	284	25245.62			
Garad	Between Respondents	3	14215.41	4738.47	0.24	0.87
	Within Respondents	281	5472032.17	19473.42		
	Total	284	5486247.58			

Table 4.36: Mean quantity (Kg/household) of the major NTFPs collected by the respondents according to education level.

Product	Illiterate N=153		Khalwa N= 20		Primary school N= 83		Secondary school N= 27		University graduate N= 2	
	Mean	Sd	Mean	Sd	Mean	Sd	Mean	Sd	Mean	Sd
Nabag	40.43	124.3	19.90	31.0	29.65	50.14	22.3	73.28	55.0	77.78
Gunglaize	13.27	52.47	38.20	71.2	13.19	43.11	8.74	29.76	0.00	0.00
Laloub	31.23	152.9	29.65	21.2	6.64	23.30	10.3	28.17	5.00	7.07
Sannamaka	18.67	21.34	279.6	116	30.27	159.0	40.5	114.5	0.135	190.9
Aradieb	19.01	91.13	0.00	0.00	9.92	38.86	7.56	17.89	0.00	0.00
Gudiem	2.66	12.42	2.05	6.73	0.79	2.43	1.30	3.24	0.00	0.00
Garad	63.17	121.4	67.51	115.	35.12	128.7	23.2	76.89	0.00	0.00

Table 4.37: Analysis of variance for the Mean Quantity (Kg/household) of the major NTFPs collected by the respondents separated by education level.

Product	Source of variation	DF	SS	MS	Calculated F	Sig.
	Between Respondents	4	16433.23	4108.31	0.44	0.78
Nabag	Within Respondensts	280	2629770.51	9392.04		
	Total	284	2646203.73			
	Between Respondents	4	915.32	228.83	0.09	0.99
Gunglaize	Within Respondents	280	662955.47	2367.70		
	Total	284	663870.79			
	Between Respondents	4	39420.25	9855.06	0.76	0.56
Laloub	Within Respondents	280	3608462.58	12887.37		
	Total	284	3647882.83			
	Between Respondents	4	1376851.32	344212.83	3.43*	0.01
Sannamaka	Within Respondents	280	28068353.89	100244.12		
	Total	284	29445205.21			
	Between Respondents	4	10650.12	2662.53	0.54	0.71
Aradieb	Within Respondents	280	1394333.87	4979.76		
	Total	284	1404983.99			
	Between Respondents	4	172.62	43.15	0.48	0.75
Gudiem	Within Respondents	280	25073.01	89.55		
	Total	284	25245.62			
	Between Respondents	4	8573.45	2143.36	0.11	0.98
Garad	Within Respondents	280	5477674.11	19563.12		
	Total	284	5486247.56			

(*) significant at the 0.05 level of significance

4.3.7 Constraints facing NTFPs collection

Collection of NTFPs was perceived by many respondents as facing certain constraints. The most frequently cited constraints are long distances to be traveled to get them and the pest and diseases affecting the products. Also the thorny nature of the trees was mentioned as a limiting factor as well as difficulty in collection (which might be related to thorny nature) and limited quantities of the products. Other constraints are of less importance and are cited in table 4.38 below.

Table 4.38 Frequency of respondents according to the constraint facing them in the collection of the NTFPs in Shiekan Province

Constraints	Frequency	%
Far distances	80	27.9
Pests & insects	45	15.7
Thorns on trees	35	12.2
Difficulty of collection	33	11.5
Shortage of product	29	10.1
Dangers	26	9.1
Land ownership	11	3.8
Fees & laws	7	2.4
Shortage of water	6	2.1
Time	4	1.4
Difficulty of carrying the product	4	1.4
Herder & nomads collect all the product	4	1.4
Animals grazing	3	1.0
Total	287	100

4.3.8 Marketing of NTFPs

The places for selling the products are organized according to the inclination of the majority of the families of the study sample to sell their products in them. The villages market and El-Obied represent the major selling places for the NTFPs according to

(24.6%) & (22.6%) of the households, respectively. There is an association between the markets chosen and type of product (table 4.39). Mean quantities sold annually by individual households are shown in table 4.40. NTFPs are mostly bought by retailers (as indicated by 40.8% of respondents) and intermediaries (as indicated by 30.3% of respondents) as depicted in table 4.41. Most respondents would pack NTFPs by using sacks and buckets. Fewer households use other containers such as trays while transporting products to the market place. The association between the means of packing products & type of product is statistically significant (table 4.42).

Table 4.39: Frequency of families according to NTFPs marketing place

Product	Market place								
	Elhila (village)	Village market	El-Obied	Khazgiel	Abukindi	Alouba	Abuharaz	Umramad	* Other
Nabag	43	54	68	40	20	14	9	8	6
Gunglaize	8	8	16	26	5	4	-	5	2
Laloub	6	28	7	4	4	15	3	1	-
Sannamaka	6	21	17	-	3	1	15	2	-
Aradieb	5	31	5	16	29	2	4	-	9
Gudiem	-	6	21	6	3	1	-	2	3
Garad	10	4	18	2	3	1	3	-	1
Total	78	152	152	94	67	38	34	18	21

χ^2= = 507.07 at level of sig. = 0.00

* Include: Um higeliga, Elkara, Elbirka, Eltina, Abugaood and Rakuna markets.

Table 4.40: Quantities of NTFPs sold annually by the families in Shiekan province (Kg/household)

Product	Quantities			
	Minimum	Maximum	Mean	Std Deviation
Nabag	.50	1000.00	28.5957	165.51936
Gunglaize	.50	240.00	45.4000	64.46688
Laloub	1.00	1020.00	98.3214	229.60966
Sannamaka	1.00	1200.00	118.5769	257.71324
Aradieb	1.00	478.00	67.5323	98.45294
Gudiem	1.00	60.00	10.1923	18.86304
Garad	1.00	1000.00	170.2308	208.00102

Table 4.41: Frequency of Buyers of NTFPs

Buyers	frequency	%
Intermediaries	84	30.3
Wholesaler	65	23.5
Retailers	113	40.8
Tannage factory	15	5.4
Total	277	100

Table 4.42: Frequency of households according to the means of packing product when transporting to the market

Product	Frequency of families according to the means of carrying the products					
	Sack	Basket	Case	Bucket	Tray(Tabag)	Other
Nabag	98	36	42	23	26	8
Gunglaize	42	6	25	2	-	-
Laloub	28	7	20	4	9	-
Sannamaka	34	4	30	4	2	1
Aradieb	54	5	39	3	-	-
Gudiem	14	9	10	7	2	-
Garad	27	4	9	2	-	-
Kawal	-	2	-	-	-	-
Mirik	1	-	-	-	-	-
Karoub	1	-	1	-	-	-
Haraz	1	-	-	-	-	-
Gebiesh	6	1	-	-	-	-
Neem	1	-	-	-	-	-
La'out	4	-	1	-	-	-
Heloy	-	1	-	-	-	-
Abanos	6	-	-	7	-	-
Total	317	75	177	52	39	9

The study shows that the main constraints facing the marketing of the NTFPs in the study area are the low prices of the products and lack of the transportation means. Table 4.43 gives detailed answerers to other constraints.

Table 4.43: Frequency of respondents according to the constraint facing them in the marketing of the NTFPs in the study area

Constraint	Frequency	%
Low prices	59	44.7
Transportations	34	25.8
Prices fluctuation	9	6.8
Fees	8	6.1
Low demand	7	5.3
Product shortage	7	5.3
Markets far	5	3.8
Competition on markets	2	1.6
Pests	1	0.8
Total	132	100

4.4 Factors affecting participation of households in the collection of NTFPs

The factors affecting participation of the surveyed households in the collection of NTFPs were studied using the binary logistic regression model (Maddala, 1983). The dependent variable in the logistic regression model is dichotomous, which in the present study is represented by the participation of the households in the NTFPs collection (Y: Dependent variable, Y= 1 respondents participate in collecting NTFPs; Y = 0 respondents do not participate in NTFPs collection). The independent variables and their expected signs are listed below. Expected signs are related to economic theory or can be considered as hypothesis:

Symbol	*Definition*	*Expected sign*
X1	*Respondent age*	*(+)*
X2	*Respondent sex (X2 = 1 male, X2 = 0 female.*	*(-)*
X3	*Respondent position in household (X3 = 1 household head, X3 = 0 except that)*	*(+)*
X4	*Respondent marital status (X4 = 1 married, X4 = 0 except that).*	*(?)*
X5	*Respondent educational level (X5 = 1 primary or secondary, X5 = 0 except that)*	*(-)*
X6	*Respondent income (1000 SP/year).*	*(-)*
X7	*Respondent family size.*	*(+)*
X8	*Respondent main occupation (X8= 1 Farmer, X8= 0 except that).*	*(?)*
X9	*Respondent Tribe (X9= 1 Bidieria, X9=0 except that).*	*(?)*
X10	*Quantity of product collected annually.*	*(+)*
X11	*Quantity of product sold annually.*	*(+)*
X12	*Place (site) of NTFPs collection (X12 = 1 family land, X12 = 0 Except that)*	*(+)*
X13	*Time of collection (X13 = 1 morning, X13 except that).*	*(?)*
X14	*Time spends in collection (hour).*	*(-)*
X15	*Frequency of collection annually*	*(?)*
X16	*Annual Quantity of product consumed at home (kg)*	*(+)*
X17	*Annual Revenue from selling product (Ls1000).*	*(+)*
X18	*Parts use from the product (X18 = 1 fruits, X18 = 0 except that).*	*(+)*
X19	*Uses of the product (X19 = 1Food or drink, X19 = 0 except that)*	*(+)*

Tables 4 .45 through 4.51 show the results of the logistic model analysis for the main NTFPs. The probability values of 0.05 and lower indicate that the probability that a particular independent variable is associated with the decision to participate in collection is statistically significant. *Chi-square* statistics indicates whether the independent variables collectively (i.e. the model) have a significant effect on the decision to collect. R^2 statistics, the coefficient of determination, estimates whether the model as a whole has a good explanatory capacity. That is by how much (percentage) do the independent variables contribute in the changes taking place in the participation of households in the NTFPs collection and how much of the changes can be attributed to other factors (unknown or immeasurable such as e.g. habits, traditions, consumption manner of the households or the climate changes).

For each estimated model the percentage of correctly classified observations is given. This reflects the robustness of the model in classifying the effectiveness of participation of households in collecting a particular product. Table (4. 44) gives a summary of this classification.

Appendices 3 through 9 show the characteristics of the households participated efficiently in the collection of the main NTFPs according to the logistic regression model classification.

Table 4.44: Summary of the classification of the logistic regression model of the effectiveness of participation of households in collecting a particular product..

Product	Number of households participating in collection						
	Total		efficiently		inefficient		Correct classification ratio
	Count	% of total	Count	% of total	Count	% of total	
Nabag	189	66.32	185	97.8	13	2.1	97.88%
Gunglaize	57	20	52	91.2	5	8.8	91.23%
Laloub	61	21.40	58	95.0	3	4.9	95.08%
Sannamaka	41	14.39	33	80.4	8	19.5	80.49%
Aradieb	48	16.84	41	85.4	7	14.6	85.42%
Gudiem	40	14.04	32	95	8	5	95%
Garad	44	15.44	22	50	22	50	50%

Evaluation of the estimated models:

All estimated models have high prediction power of classification (observations correctly classified) and the models have a good explanatory capacity (R^2) of more than 75%, except in the case of *Garad* (Model 7) which is 55%. The explanatory variables included in the models are jointly of high significance (0.00) as reflected by the chi-squire statistic.

Effects of socioeconomic factors on participating of households in collection of NTFPs

For different products (models), different factors are significant in the decision to collect. The size of the effect was measured by the odds ratio, which is an indicator of the change in the odds because of a unit change in the explanatory variable:

- **Age** of collectors was significant in the case of ***Laloub*** only. Increasing age by one year decreases, on average the probability of participation in collecting ***Laloub*** by a factor of 7.5 compared to the previous state, *citrus paribus*. Age is not a significant factor in other products.
- **Gender** was significant in the case of ***Gunglaize, Sanamaka*** and ***Garad*** only. Being a male increases, on average, the probability of participation in collection by a factor of 2.4 for ***Gunglaize,*** and a factor of 2.9 for ***Garad,*** while it deceases the probability by a factor of 0.99 for ***Sanamaka*** compared to females, *citrus paribus*. Gender was the strongest variable in the case of *Sanamaka* (ß= -1.86) compared to other factors.
- **Position in the household** of collectors was significant in the case of ***Nabag*** and ***Sanamaka*** only. Being a head of the household increases, on average, the probability of participation in collection of ***Nabag*** by a factor of 1.76; and by a factor of 0.155 for ***Sanamaka as compared to being a homemaker or a child,*** *citrus paribus*. Position in the household has no effect on the decision to collect other products. Position in the household was the strongest variable in the case of Nabag (ß= 0.57) compared to other factors affecting collection of this product.
- **Marital Status of respondent** was significant in the case of ***Garad*** only. Being married decreases, on average, the probability of participation in collecting ***Garad*** by a factor of 0.34, *citrus paribus,* as compared to single collectors. For the other products, it does not matter whether the collector is married or not.
- **Education level of the collector:** was significant in the case of ***Gunglaize*** and ***Sanamaka*** only. If the participant is a graduate of a primary school, his/her probability of participating in the collection decreases for ***Gunglaize*** by a factor of 0.206, and increases for ***Sanamaka*** by a factor of 3.55 as compared to other levels of education, *citrus paribus*.

- **Income** was significant in the case of ***Nabag***, ***Gunglaize***, ***Laloub*** and ***Gudiem*** only. Increasing income, *on average,* by one unit decreases the probability of participation by a factor of 0.99, 0.99, 0.001 and 0.99, respectively**.** Income has no effect at all on the decision to collect *Garad* and the other products, *Citrus paribus.*
- **Family size**: was significant in the case of ***Laloub*** only. As the size of the family increases by one unit (person) the probability of participation of the household in collection of Laloub increases by a factor of 0.998, *citrus paribus*. This factor had the strongest effect among the other factors in the case of Laloub (ß= 0.57)
- **Occupation of head of household**: was significant in the case of ***Gunglaize*** and ***Garad***. When the household head is a farmer, this decreases the probability of participation by a factor of 0.062 in case of ***Gunglaize***, and by a factor of 0.357 in the case of ***Garad*** as compared to other occupations, *citrus paribus*. Occupation of head of household is the strongest factor for participation in the case of ***Gunglaize*** (ß = -2.77)
- **Tribe**: was significant in the case of ***Sanamaka*** and ***Garad*** only. Being a member of the *Bidieria* tribe, on average, decreases the probability of participation in the collection of ***Sanamaka*** by a very large factor, and increases the probability by a factor of 1.57 for ***Garad:*** as compared to participants from other tribes, *citrus paribus*.
- **Collected Quantity** was significant in the case of ***Gudiem*** and ***Garad*** only. As collected quantity increases, (i.e. more is available) by one unit the probability of participation increases by a factor of 0.259 as compared to the previous quantity, *citrus paribus***.** Collected quantity has no effect at all on the decision to collect other products. Collected quantity is the strongest factor in the case of ***Garad*** (ß = -1.34).
- **Sold Quantity** of the product has no effect on the decision of collecting any of the products.
- **Collection Site (place)**: was significant in the case of ***Aradieb*** and ***Gudiem*** only. If the collection place is the family land, the probability of participation increases, *citrus paribus,* by a factor of 1.038 in the case of Aradieb while it decreases by a

small factor in the case of ***Gudiem*** as compared to other sites of collection. **Site** is the strongest factor affecting participation in the case of ***Gudiem*** (ß = -12.06).

- **Collection time**: This factor has no effect on the participation in collecting any of the NTFPs.
- **Collection duration**: was significant in the case of ***Nabag, Aradieb,*** and ***Gudiem***. Increasing the duration of collection by one hour, on average, increases the probability of participation by a factor of 2.51 for ***Nabag;*** 13.15 for ***Aradieb;*** and 15.07 for **Gudiem*, citrus paribus***, as compared to previous durations. Duration of collection is the strongest factor in case of ***Nabag***.
- **Collection frequency**: was significant in the case of ***Nabag*** and ***Gudiem*** only. Increasing the frequency of collection by one unit, *citrus paribus,* increases the probability of participation in the case of Nabag by a factor of 1.102 and decreases the probability for ***Gudiem*** by a factor of 0.833 as compared to the previous state, *citrus paribus***.** frequency has no effect at all on the decision to collect in the case of the other products.
- **Consumed quantity by households**: was significant in the case of ***Gudiem*** and ***Nabag*** . Increasing consumption of ***Gudiem*** by one unit, *citrus paribus,* increases the probability of participation by a factor of 4.32, as compared to previous state of consumption. While increasing consumption of ***Nabag*** by one unit, *citrus paribus,* increases the probability of participation by a factor of 1.82, as compared to previous state of consumption.
- **Revenue from collection**: was significant in the case of ***Gudiem*** and ***Nabag***. As revenue from the sale of ***Gudiem*** and that of ***Nabag*** increases by one unit, *citrus paribus,* the probability of participation for ***Gudiem*** decreases by a factor of 0.80. and that of ***Nabag*** decreases by 0.98 (Although *this is not very logical, we kept this factor in the mode).*
- **Parts used**: was significant in the case of ***Gudiem*** only. When the use for the product as (edible) fruit increases, *citrus paribus*, the probability of participation increases by a factor of 77.23, as compared to the state of using other parts.
- **Uses of the product**: was significant in the case of ***Gudiem*** only. Using Gudiem as a food or drink increases the probability of participation by a very large factor,

as compared to other uses. This factor is the most important one that affects the participation in collecting ***Gudiem*** (ß= 15.65), as compared to other factors.

Table 4.45 Model (1) Logistic regression model for the probability of participation of households in *Nabag* collection

Independent Variable	Coefficient (ß)	Significant level	Odd ratios = $e^{ß}$ (95% CI)		
			Lower	$e^{ß}$	Upper
Constant	-2.0136	0.0740			
Age	0.0145	0.3455	0.9845	1.0146	1.0457
Sex	0.3567	0.5059	0.4995	1.4286	4.0861
Position in household	0.5702*	0.0409	0.6409	1.7686	4.8803
Marital status	-0.1456	0.7927	0.2917	0.8645	2.5617
Education level	0.3328	0.5365	0.4856	1.3949	4.0070
Income	-0.0004**	0.0073	0.9992	0.9996	0.9999
Family size	-0.0501	0.5941	0.7910	0.9511	1.1437
Occupation	0.0864	0.8968	0.2956	1.0902	4.0212
Tribe	- 0.1734	0.4978	0.5093	0.8408	1.3881
Collected quantity	0.0050	0.9168	0.9148	1.0050	1.1042
Sold quantity	- 0.0050	0.9221	0.8997	0.9950	1.1003
Collection site	- 0.0800	0.8875	0.3048	0.9231	2.7960
Collection time	-0.0194	0.9702	0.3541	0.9808	2.7167
Collection duration	0.9205**	0.0000	1.6567	2.5105	3.8046
Frequency	0.0972*	0.0339	1.0074	1.1021	1.2056
Consumed quantity	0.6024**	0.0003	1.3144	1.8265	2.5381
Revenue	- 0.016*	0.0438	0.9664	0.9841	1.0021
Parts used	- 0.6936	0.3406	0.1200	0.4998	2.0809
Uses	0.9350	0.2007	0.6082	0.1335	10.6680
Chi-square	233.327				
Significance	0.000				
R^2	75%				
Observations correctly classified	92.98%				

* Significant at 5% level; ** Significant at 1% level

Table 4.46: Model (2) Logistic regression model for the probability of participation of households in *Gunglaize* collection

Independent Variable	Coefficient (ß)	Significant level	Odd ratios $= e^{ß}$ (95% CI)		
			Lower	$e^{ß}$	Upper
Constant	2.0227	0.4110			
Age	-0.0052	0.8910	0.9229	0.9948	1.0723
Sex	0.8846*	0.0479	0.3532	2.4220	16.610
Position in household	0.2839	0.7940	0.1520	1.3283	11.610
Marital status	-0.6764	0.5301	0.0615	0.5084	4.2005
Education level	-1.5788*	0.0477	0.0177	0.2062	2.4040
Income	-0.0034*	0.0425	0.9933	0.9966	0.9999
Family size	-0.0657	0.6894	0.6784	0.9364	1.2925
Occupation	-2.7771**	0.0088	0.0078	0.0622	0.4971
Tribe	-0.2811	0.5666	0.2887	0.7550	1.9742
Collected quantity	-0.0342	0.7558	0.7787	0.9664	1.1991
Sold quantity	0.0549	0.6952	0.8027	1.0564	1.3905
Collection site	-12.189	0.9098	0.0000	0.0000	1.9086
Collection time	5.3424	0.9454	0.0000	209.013	5.7568
Collection duration	2..2543	0.9437	0.0000	9.5286	1.4028
Frequency	-0.0477	0.9916	0.0001	0.9534	6828.85
Consumed quantity	0.0166	0.9959	0.0019	1.0167	547.027
Revenue	-0.0585	0.9138	0.3271	0.9432	2.7195
Parts used	20.208	0.8193	0.0000	1.2214	1.0884
Uses	4.4118	0.9783	0.0000	1.5095	7.4139
Chi-square	241.004				
Significance	0.000				
R^2	90%				
Observations correctly classified	97.54%				

* Significant at 5% level; ** Significant at 1% level; V.l.: Very large values

Table 4.47: Model (3) Logistic regression model for the probability of participation of households in *Laloub* collection

Independent Variable	Coefficient (ß)	Significant level	Odd ratios = $e^{ß}$ (95% CI)		
			Lower	$e^{ß}$	Lower
Constant	-57.9925	0.9396			
Age	-0.1221*	0.0488	0.6160	7.5587	
Sex	-10.5785	0.9483	0.0000	0.8851	2.4134
Position in household	16.8618	0.9588	0.0000	0.0000	6.8249
Marital status	32.2251	0.9498	0.0000	VL	V.L
Education level	-6.8787	0.9642	0.0000	VL	2.8127
Income	-0.0011*	0.0461	0.9947	0.0010	1.0031
Family size	0.5560*	0.0341	0.5379	0.9989	5.6580
Occupation	7.3441	0.9897	0.0000	1.7437	V.L
Tribe	-5.1655	0.9661	0.0000	1547.0420	2.0101
Collected quantity	15.4807	0.9749	0.0000	0.0057	V.L
sold quantity	-16.3925	0.9749	0.0000	VL	V.L
Collection site	66.4921	0.9808	0.0000	0.0000	V.L.
Collection time	43.5876	0.9263	0.0000	VL	V.L
Collection duration	0.2216	0.9989	0.0000	VL	8.5139
Frequency	11.3848	0.9764	0.0000	1.2481	V.L
Consumed quantity	23.4603	0.9805	0.0000	VL	V.L
Revenue	-0.0094	0.9181	0.8273	VL	1.1861
Parts used	-73.4300	0.9743	0.0000	0.9906	V.L
Uses	-36.8393	0.9861	0.0000	0.0000	V.L
Chi-square	288.434				
Significance	0.000				
R^2	99%				
Observations correctly classified	99.65%				

* Significant at 5% level; ** Significant at 1% level; VL = very large number.

Table 4.48: Model (4) Logistic regression model for the probability of participation of households in *Sannamaka* product collecting

Independent Variable	Coefficient (ß)	Significant level	Odds ratio (95% C.I)		
			Lower	$e^{ß}$	Upper
Constant	-17.1081	0.9666			
Age	-0.0032	0.9153	0.9403	7.5587	1.0568
Sex	-1.8640*	0.0177	0.0160	0.9968	1.5027
Position in household	0.8359*	0.0388	0.4612	0.1551	11.5396
Marital status	1.2694	0.2755	0.3634	2.3069	34.8495
Education level	0.9270*	0.0425	0.5339	3.5587	11.9335
Income	0.0001	0.4614	0.9998	2.5269	1.0005
Family size	0.0048	0.9732	0.7336	1.0001	1.3311
Occupation	12.6511	0.9753	0.0000	1.0048	V.L
Tribe	-0.7044*	0.0215	0.1678	V.L	1.4571
Collected quantity	0.4374	0.9483	0.0000	0.4944	846087
Sold quantity	-1.1700	0.9316	0.0000	1.5487	1.2311
Collection site	-3.8222	0.9821	0.0000	0.3104	3.1143
Collection time	-30.4935	0.9698	0.0000	0.0219	V.L
Collection duration	-1.5194	0.9792	0.0000	0.0000	7.0048
Frequency	2.1643	0.8966	0.0000	0.2188	1.3115
Consumed quantity	-0.4144	0.9559	0.0000	8.7085	1574886
Revenue	0.4016	0.9155	0.0000	0.6607	2489.75
Parts used	41.8165	0.9569	0.0000	1.4942	V.L
Uses	17.6389	0.9645	0.0000	V.L	V.L
Chi-square	174.285				
Significance	0.000				
R^2	82%				
Observations correctly classified	97.19%				

* Significant at 5% level; ** Significant at 1% level; V.L: Very large values

Table 4.49: Model (5) Logistic regression model for the probability of participation of households in *Aradieb* product collection

Independent Variable	Coefficient (ß)	Significant level	Odds ratio (95% C.I)		
			Lower	$e^{ß}$	Upper
Constant	-1.1737	0.5193			
Age	-0.0314	0.3162	0.9115	7.5587	1.0304
Sex	-0.0446	0.9564	0.1934	0.9691	4.7301
Position in household	0.0380	0.9644	0.2062	0.9564	5.2445
Marital status	-0.0624	0.9461	0.1541	1.0387	5.7295
Education level	0.4759	0.5651	0.3181	0.9395	8.1429
Income	0.0001	0.7000	0.9997	1.6095	1.0005
Family size	-0.1073	0.4583	0.6765	1.0001	1.1928
Occupation	-0.8641	0.3526	0.0682	0.8983	2.6057
Tribe	-1.2447*	0.0487	0.0754	0.4214	1.1001
Collected quantity	0.0022	0.9263	0.9570	0.2880	1.0495
Selled quantity	0.0378	0.2870	0.9687	1.0022	1.1144
Collection site	2.9037*	0.0427	0.9671	1.0385	344.07
Collection time	2.5769	0.1170	0.5244	18.2415	440.08
Collection duration	0.7574*	0.0455	0.8996	13.1563	5.0562
Frequency	-0.0364	0.2818	0.9024	2.1327	1.0303
Consumed quantity	0.1243	0.3699	0.8629	0.9643	1.4861
Revenue	-0.0231	0.254	0.9576	1.0000	0.9972
Parts used	1.3275	0.2530	0.3873	0.9772	36.7449
Uses	2.0556*	0.0407	0.9934	3.7716	61.4272
Chi-square	189.075				
Significance	0.000				
R^2	81%				
Observations correctly classified	96.49%				

*: Significant at 5% level;**: Significant at 1% level;

Table 4.50 Model (6) Logistic regression model for the probability of participation of households in *Gudiem* product collecting

Independent Variable	Coefficient (ß)	Significant level	Odds ratio (95% C.I)		
			Lower	$e^{ß}$	Upper
Constant	-0.7377	0.7898			
Age	-0.0608	0.1930	0.8588	0.9410	1.0312
Sex	-0.3238	0.7845	0.0710	0.7234	7.3692
Position in household	4.5422	0.0751	0.6316	93.8971	13959.7
Marital status	-0.2305	0.8655	0.0551	0.7941	11.4392
Education level	0.9126	0.3883	0.2355	2.4908	26.3495
Income	-0.0057**	0.0038	0.9904	0.9943	0.9981
Family size	-0.3675	0.1047	0.3842	0.6925	1.0794
Occupation	1.5354	0.4252	0.1061	4.6432	203.202
Tribe	-1.2547	0.0892	0.0671	0.2852	1.2120
Collected quantity	1.0965**	0.0072	1.3455	2.9937	6.6614
sold quantity	0.2107	0.3173	0.8169	1.2345	1.8656
Collection site	-12.0686*	0.0227	0.0000	0.0000	0.1851
Collection time	-11.1057	0.0626	0.0000	0.0000	1.7950
Collection duration	2.7129*	0.0152	1.6875	15.0729	134.639
Frequency	-0.1827*	0.0427	0.6925	0.8330	1.0021
Consumed quantity	1.4648*	0.0439	0.9754	4.3267	19.1916
Revenue	-0.2176**	0.0015	0.7034	0.8044	0.9201
Parts used	4.3468**	0.0066	3.3593	77.2309	1775.73
Uses	15.6531**	0.0091	49.336	6281378.3698	V.L
Chi-square	191.547				
Significance	0.000				
R^2	88%				
Observations correctly classified	97.89%				

* Significant at 5% level; **Significant at 1% level

Table 4.51 Model (7) Logistic regression model for the probability of participation of households in *Garad* product collecting

Independent Variable	Coefficient (ß)	Significant level	Odds ratio (95% C.I)		
			Lower	$e^{ß}$	Upper
Constant	-2.5491*	0.0191			
Age	0.0179	0.3020	0.9841	1.0181	1.0531
Sex	1.0694*	0.0419	1.0398	2.9136	8.1650
Position in household	-0.5547	0.3474	0.1806	0.5742	1.8261
Marital status	-1.0655*	0.0442	0.1164	0.3446	1.0195
Education level	0.1430	0.7770	0.4289	1.1537	3.1033
Income	0.0000	0.7592	0.9996	1.0000	1.0003
Family size	0.0709	0.4195	0.9037	1.0735	1.2752
Occupation	-1.0293*	0.0359	0.1104	0.3573	1.1565
Tribe	0.4560*	0.0327	0.9589	1.5778	2.5961
Collected quantity	-1.3494*	0.0454	0.0000	0.2594	1.219
Sold quantity	2.0683	0.7340	0.000	7.9114	1. 989
Collection site	0.8622	0.9942	0.0000	2.3684	7.5101
Collection time	304.948	0.8652	0.0000	V.L	V.L
Collection duration	-5.5500	0.7623	0.0000	0.0039	1.6213
Frequency	-0.7363	0.9161	0.0000	0.4789	426286
Consumed quantity	4.3779	0.8249	0.0000	79.6705	5.5418
Revenue	-0.1636	0.8439	0.1667	0.8491	4.3245
Parts used	306.120	0.8715	0.0000	V.L	V.L
Uses	-296.610	0.8747	0.0000	0.0000	V.L
Chi-square	109.866				
Significance	0.000				
R^2	55%				
Observations correctly classified	92.28%				

* Significant at 5% level; ** Significant at 1% level; V.L: Very large values.

4.5 Factors affecting household's use of trees and forests for non timber services

Table 4.52 indicates that shade and recreation services of trees and forests are the most important services used by respondents. Distribution of users of the recreation services shows that people of Um Higeiliga village are the most ones who use the recreational services provided by the trees and forests in the study area followed by those of Abu Gaoud village (Table 4.53), this most probably because these villages found near a forest or trees site.

Table 4.52: Frequency of respondents using different services provided by trees and forests in Shiekan province

Use	Frequency	%
Shade	121	33.8
Recreation	109	30.5
Site for children play	85	23.7
Belt	43	12.0
Total	358	100

Table 4.53: Distribution of respondents in the use of the recreational services provided by the trees and forests in the study area according to their village

Village	Frequency	%
Um Higeiliga	21	40.38
Abu Gaoud	11	21.15
Alouba	5	9.62
El Hamadia	4	7.69
Um Arada	3	5.77
Shushaie	3	5.77
Fanguga	3	5.77
El kaw	2	3.85
Total	52	100

Factors affecting the use of the trees and forests by the surveyed households for recreation were studied using the binary logistic regression model. The dependent variable in the logistic regression model is dichotomous, which in the present study is represented by the participation of the households in using the trees and forests for recreation (Z: Dependent variable, Z= 1 respondents participate in recreation; Z = 0 respondents do not participate in recreation). The independent variables and their expected signs were:

Symbol	***Definition***	***Expected sign***
W1	*Respondent age*	*(-)*
W2	*Respondent sex (W2 = 1 male, W2 = 0 female).*	*(+)*
W3	*Respondent position in household (W3 = 1 household head, W3 = 0 except that)*	*(-)*
W4	*Respondent marital status (W4 = 1 married, W4 = 0 except that).*	*(-)*
W5	*Respondent educational level (W5 = 1 primary or secondary, W5 = 0 except that)*	*(+)*
W6	*Respondent income (Ls 1000 /year).*	*(+)*
W7	*Respondent village (W7 = 1 Um Higaliga, W7 = 0 except that)*	*(+)*
W8	*Respondent main occupation (W8= 1 Farmer, W8= 0 except that).*	*(?)*
W9	*Respondent Tribe (W9= 1 Bidieria, W9=0 except that).*	*(?)*

Table 4.54: Logistic regression model for the probability of participation of households in recreation

Independent Variable	Coefficient (ß)	Significant level	Odds ratio (95% C.I)		
			Lower	e^{β}	Upper
Constant	-0.4864	0.4355		0.614836	
Age	0.0011	0.9018	0.9831	1.001101	1.0195
Sex	0.1589	0.5957	0.6517	1.172221	2.1085
Education level	-0.4191	0.1595	0.3667	0.657638	1.1792
Main occupation	0.2192	0.5589	0.5970	1.24508	2.5969
Marital status	0.0540	0.8645	0.5676	1.055485	1.9629
Position in household	-0.9412**	0.0018	0.2158	0.390159	0.7053
Income	0.0002	0.0621	1.0000	1.0002	1.0003
Tribe	-0.0658	0.8180	0.5344	0.936318	1.6405
Village	0.9703*	0.0212	1.1516	2.638736	6.0236
Chi-square	20.377				
Significance	0.0157				
R^2	9%				
Observations correctly classified	92.98%				

* Significant at 5% level; ** Significant at 1% level.

Table (4.54) shows that the independent variables collectively at the level of significance (0.05), has an essential effect on the dependent variable which represent the household use of the recreation activities based on the probability value of the model (0.0157) which is less than (0.05). The coefficient of determination for the model was found to be (9%) i.e. the independent variables contribute by (9%) in the changes take place in the use of the recreational services by the households. Where as (91%) of the changes in the use of the households for the recreational services was attributed to immeasurable variables e.g. habits, traditions, the consumption manner of the households or the climate changes.

When looking for the effect of each independent variable separately on the dependent variable, two variables were detected. The position in household effect was found to be essentially on the use of the households for recreational services at the level of significant (0.01). Where as respondents' village affect at the significant level (0.05). The interpretation of the effect is that being a head of the household decreases, on average, the probability of participation in recreation facility by a factor of 0.390. On the other hand, being from Um Hiegliga village increases the probability of participation in recreation by a factor of 2.63. When comparing the different levels of significant for the two significant variables, the village of the respondent was stronger (ß = -.9703) than the position in the household of the respondent (ß = -.9412).

The Chi-2 value for the model was found to be (20.377) at the level of significant (0.0157) which reflects the high potential of this model to classify the households according to their participation in the recreational activities. It is evident from the analysis that 109 households (38.25% of the total number of households) participate in recreation. Of these 52 households participate efficiently (Appendix 10 show the characteristics of these households) with a correct classification ratio of (47.71%) while 57 households participate inefficiently with an incorrect classification ratio of (52.29%).

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Appendix

Appendix 1. Households questionnaire

Contribution of non-timber forests products (NTFPs)
(other than gum Arabic) in households livelihood
(Northern Kordofan State- Shiekan Province)
Households questionnaire

Date of interview……..2003
Name of interviewer………..

Unit (1) :
Demographic Data :-
Locality ………… Unit……….. Village……… Tribe……..
1-1 Name of the respondent……….

1-2 Age of the respondent……years.

1-3 Sex Male () Female()

1-4Position in household Household head () Dependent ()

1-5 Marietal status single () married () divorce () widow ()

1-6 Educational level illiterate () kalwa () primary () secondary () graduate () postgraduate ()

1-7 Household members

Household members	Age	Sex	Level of education	Occupation	Relation to the household head

1-8 What is your main job (occupation) farmer () merchant () government employee () others (specify)
1-9 What are your main sources of income agriculture () animals () NTFPs () others (specify)
1-9-1 If you have another occupation (e.g. merchant or teacher) please give an estimate of your annual in come ……………LS/ year
1-10What is your seasonal calendar

Activity	J	F	M	A	M	J	J	A	S	O	N	D
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												

Unit (2)
Non- timber forest products :

2-1 What type of energy does the family use and for what purpose ?
Type A)………………b)………………..c)……………….d)…………………
Purpose A)……………b)……………….c)………………..d)…………………

2-2 How does the family get the firewood and charcoal ?
a) by collection () a.1) from fallen trees and twigs a.2) cutting down trees
b) from the market () c)others (specify) ()

2-3 if by collection , who collects it and from where ?

Collector	Family land	Gifar land	Governmental land
Father			
Mother			
Children/F /M			
others			

2-4 What are other important NTFPs do you collect from the forest or other areas and what are their sources

		Sources				
Produce	Place of collection	Tree	Shrub	Herb	Animal	Others (specify)

2-5 Who collects these products and from where and at what time of the day ?

Collector	Own land Distance traveled	Gifar land Distance traveled	Governmental land Distance traveled	Other (specify) Distance traveled	Time of the day and time spent in, collection
Father					
Mother					
Children /males/females					
Others (specify)					

2-6 Which period do you collect each produce ?

Produce	J	F	M	A	M	J	J	A	S	O	N	D

2-7 How often and how much do you collect and how much do you use at home and how much do you sell and the price ?

Produce	Frequency	Quantity collected each time	Unit of measurement	Part use at home	Part sell	Price	Place of sale

2-8 Do you collect all the NTFPs available on the tree and why ?
yes () no ()

2-9 if no (reason) ? a)………………..b)………………….c)………………….

2-10 which parts are used ?

Produce	Leaves	fruits	seeds	Flowers	stems	roots	branches	Oils/resins/latex	Others (specif)

2-11 What are the uses of these products and in what forms are they used (give detailed description)?

Produce	food	drink	medicine	fodder	cosmetic	raw material for local industry (specify)	Others (specify)

Make a * on the use if used by respondent 's household

2-12 Who uses these products and when ?

produce	Time of use	Father	mother	Children/males/females	Others(specify)

2-13 How do you collect the produce and what tools do you use (if any) ?

produce	1	2	3	4	5	6

1. climb the tree, 2. shedding fruits by using stick, 3. cutting the leaves, 4. using mats 5. hand picking from the ground, 6. others (specify)……….

2-14 How do you handle and store the produce

2-15 Is there any processing or treatment for the produce before use , storage or sale ?
yes () no ()

2-16 If yes what is it and why is it done?

produce	Sorting / reason	Grading / reason	Chipping/ reason	Others(specify)reason

2-17 from where do you have the knowledge of extraction, handling , storage and uses ?
………………………………………………………………………………..

2-18 Where do you sell the produce ?
a) village b) nearby village c) others (specify)

2-19 Who takes the produce to the market and why this person in particular ?
a) father (reason) b) mother (reason) c) others (specify) (reason)

2 – 20 who gets the revenue from sale ?

2-21 How do you transport to the market ? and what is the transportation cost ?

Produce	Donkey/ cost	Karo/ cost	Lorry/ cost	Others (specify)

2-22Who buy your produce ? Describe the marketing chain ………………………...

2-23 Is there any preferences concerning the market , e.g. demand for certain types, varieties or qualities ?

2-24 Do you pay any fees for collection ? yes () no ()

2-25 If yes what type of payment and how much and how is the payment calculated ?

Type of payment	produce	Payment to forest Adm.	To salvation committee	To rural council	To others (specify)	Total payment
Fees						
Tax						
Royality						
Others (specify)						

2 – 26 do you pay any fees for selling the produce ? yes ( ) no ( )

2-27 If yes what type of payment and how much and how is the payment calculated ?

Type of payment	produce	Payment to forest Adm.	To salvation committee	To rural council	To others (specify)	Total payment
Fees						
Tax						
Royality						
Others (specify)						

2– 28 What are the problems and constraints facing the collection of NTFPs ?
1………………………………
2………………………………
3………………………………
4………………………………
5………………………………

2– 29 What are the problems and constraints facing the marketing of NTFPs ?
1………………………………
2………………………………
3………………………………
4………………………………
5………………………………

2-30 Do you practice any management to develop or enhance NTFPs ?
yes () no ()

2-31 If yes ,how ? a)……………….b)……………….c)……………….

2-32 In what other ways do you get use of the trees and forests ?
a) recreation b) children play c) shade for animals d) ecotourism e) others (specify)
2-33 How do you perceive these forests and trees and their products ?

Appendix 2. Latin names and their correspondence Vernacular names of the NTFPs mentioned to be present by the surveyed households in the study area.

Species	Vernacular Name
Zizyphus spina-christi(linn.)	*sidir (nabag)*
Adansonia digitata l.	*Tabeldi(gongleiz) (baobab)*
Balanites aegyptiaca del.	*Heglig(laloub)*
Cassia senna l.	*sanamacka*
Tamarindus indica l.	*aradeib*
Grewia Tenax	*gudeim*
Acacia nilotica(l) wild ex del	*sunt(garad)*
Cassia *obtusifolia*	*kawal*
Acacia albida del.	*haraz*
Acacia nubica benth	*la'ot*
Acacia tortilis (forsk) hayne	*seyal*
Boscia senegalensis (pers) Lam.ex poir	*mukheit (kursan)*
Calatropis procera (ait)	*ushar*
Combretum hartmannianum schwein	*habeel*
Dalbergia melanoxylon gwill &perr	*abanos*
Guira senegalensis gmel	*ghibeish*
Grewia flavescens juss	*haloy*
Leptadenia pyrotechnica decn	*marikh*
Maeruia crassifolia forsk	*sirih*

Species	Vernacular Name
Acacia mellifera	*Kitir*
Piliostigma reticulatum hochst	*Karu*
Sclerocarya birrea hochst	*Humeid*
Acacia seyal	*Talh*
Terminalia sp.	*Subagh*
Acacia laeta	*Shabahi*
Combretum aculeatum vent	*Shuheit*
Prosopis chilensis	*Misquite*
Cordia abyssinica r..br.	*Gumbil*
Azadirachta indica A. Juss	*Neem*
Capsicum frutescens	*Shaat*
Aristida sp.	*Um Semama*

Appendix 3. Characreistics of the families participated efficiently in Nabag collection in Shiekan Province.

Table 1: Distribution of respondents according to their age-groups.

Age- group	Frequency	%
< 20	1	0.54
20-25	5	2.70
25-30	15	8.11
30-35	19	10.27
35-40	21	11.35
40-45	33	17.84
45-50	26	14.05
50-55	18	9.73
55-60	13	7.03
60-65	17	9.19
65-70	10	5.41
70-75	3	1.62
>75	4	2.16
Total	185	100

Table 2: Distribution of respondents according to their sex.

Sex	frequency	%
Male	66	35.68
Female	119	64.32
Total	185	100

Table 3: Distribution of respondents according to the position in household

Position inhousehold	Frequency	%
Household head	113	61.08
Dependent	72	38.092
Total	185	100

Table 4: Distribution of respondents according to the marital status

Marital status	Frequency	%
Married	145	78.38
Single	12	6.49
Divorce	6	3.24
Widow	2	1.08
Total	185	100

Table 5: Distribution of respondents according to the education level

Education	Frequency	%
Primary/Secondary	57	30.81
Illiterate	126	68.11
University graduate	2	1.08
Total	185	100

Table 6: Distribution of respondents according to their income

Income group/000 SP.	Frequency	%
< 400	25	13.51
400-800	53	28.65
800 – 1200	39	21.08
1200- 1600	29	15.68
1600- 2000	11	5.95
2000-2400	6	3.24
2400-2800	5	2.70
2800-3200	6	3.24
> 3200	11	5.95
Total	185	100

Table 7: Distribution of respondents according to their main occupation

Occupation	Frequency	%
Farmer	159	85.95
Trader	4	2.16
Housewife	6	3.24
Unemployed	1	0.54
Others	15	8.11
Total	185	100

Table 8: Distribution of respondents according to the family size

No.of family members	Frequency	%
1-3	43	23.24
4-6	71	38.38
7-9	58	31.35
10-12	11	5.95
13-15	2	1.08
Total	185	100

Table 9: Distribution of respondents according to the tribe

Tribe	Frequency	%
Bedieria	66	35.68
Kinana	17	9.19
Tumam	15	8.11
Manasra	10	5.41
Galabahawara	10	5.41
Baniumran	11	5.95
Shiwehat	8	4.32
Banifadul	6	3.24
Gidiat	4	2.16
Miseria	3	1.62
Bargo	4	2.16
Gawama	2	1.08
Others	29	15.68
Total	185	100

Table 10: Distribution of respondents according to the quantities they collect

Quantities collected/annually/kg	Frequency	%
< 10	68	36.76
10-20	29	15.68
20-30	24	12.97
30-40	16	8.65
40-50	9	4.86
50-60	1	0.54
60-70	9	4.86
70-80	1	0.54
>80	28	15.14
Total	185	100

Table 11: Distribution of respondents according to the selled quantity

Quantities selled/annually	Frequency	%
<10	93	50.27
10-20	26	14.05
20-30	18	9.73
30-40	8	4.32
40-50	4	2.16
50-60	5	2.70
60-70	2	1.08
>70	25	13.51
Total	185	100

Table 12: Distribution of respondents
according to the place of collection

Place of collection	Frequency	%
Family land	127	68.65
Gifar land	46	24.86
Forest	7	3.78
Other	5	2.70
Total	185	100

Table 13: Distribution of respondents
according to the time of collection

Time of collection	Frequency	%
Morning	160	86.49
Midday	20	10.81
Evening	5	2.70
Total	185	100

Table 14: Distribution of respondents
according to the time spent in collection

Time/hour	Frequency	%
<2	31	16.76
2-4	75	40.54
4-6	50	27.03
6-8	16	8.65
8-10	8	4.32
10-12	5	2.70
Total	185	100

Table 15: Distribution of respondents
according to the frequency of collection

Frequency of collection	Frequency of families	%
1-10	115	62.16
11-20	38	20.54
21-30	17	9.19
31-40	5	2.70
41-50	3	1.62
>50	7	3.78
Total	185	100

Table 16: Distribution of respondents
according to the consumed quantity

Quantity consumed	Frequency	%
<10	68	36.76
10-20	29	15.68
20-30	24	12.97
30-40	16	8.65
40-50	9	4.86
50-60	1	0.54
60-70	9	4.86
>70	29	15.68
Total	185	100

Table17: Distribution of respondents
according to the revenue from selling the product

Revenue	Frequency	%
<100	166	89.73
100-200	8	4.32
200-300	6	3.24
300-400	1	0.54
400-500	1	0.54
500-600	2	1.08
>600	1	0.54
Total	185	100

Table 18: Distribution of respondents
according to the parts used of the product

Parts use	Frequency	%
Leaves	68	36.76
Fruits	91	49.19
Bark	12	6.49
Branches	14	7.57
Total	185	100

Table 19: Distribution of respondents
according to the uses of the product

Uses	Frequency	%
Food & drink	109	58.92
Medicine	15	8.11
Fodder	28	15.14
Cosmotic	20	10.81
Raw material	7	3.78
Other	6	3.24
Total	185	100

Appendix 4: Characreistics of the families participated efficiently in Gunglaize collection in Shiekan Province.

Table 1: Distribution of respondents according to their age-groups.

Age- group	Frequency	%
20-25	11	21.15
25-30	6	11.54
30-35	5	9.62
35-40	5	9.62
40-45	5	9.62
45-50	5	9.62
50-55	4	7.69
55-60	3	6.77
60-65	2	3.85
65-70	5	9.62
70-75	1	1.92
>75	-	-
Total	52	100

Table 2: Distribution of respondents according to their sex.

Sex	frequency	%
Male	35	67.31
Female	17	32.69
Total	52	100

Table 3: Distribution of respondents according to the position in household

Position inhousehold	Frequency	%
Household head	22	42.31
Dependent	30	57.69
Total	52	100

Table 4: Distribution of respondents according to the marital status

Marital status	Frequency	%
Married	12	23.08
Single	40	76.92
Total	52	100

Table 5: Distribution of respondents according to the education level

Education	Frequency	%
Primary/Secondary	18	34.62
Illiterate	34	65.38
Total	52	100

Table 6: Distribution of respondents according to their income

Income group/000 SP.	Frequency	%
< 400	8	15.38
400-800	18	34.62
800 – 1200	12	23.08
1200- 1600	2	3.85
1600- 2000	4	4.71
2000-2400	3	5.77
2400-2800	1	1.92
2800-3200	2	3.85
> 3200	2	3.85
Total	52	100

Table 7: Distribution of respondents according to their main occupation

Occupation	Frequency	%
Farmer	44	84.62
Housewife	6	11.54
Unemployed	2	3.85
Total	52	100

Table 8: Distribution of respondents according to the family size

No.of family members	Frequency	%
1-3	13	25.00
4-6	13	25.00
7-9	20	38.46
10-12	5	9..62
13-15	1	1.92
Total	52	100

Table 9: Distribution of respondents according to the tribe

Tribe	Frequency	%
Bedieria	18	34.62
Kinana	8	15.39
Tumam	6	11.54
Manasra	4	7.69
Galabahawara	4	7.69
Others	12	23.08
Total	52	100

Table 10: Distribution of respondents according to the quantities they collect

Quantities collected/annually/kg	Frequency	%
< 10	37	71.15
10-20	5	9.62
20-30	2	3.85
30-40	1	1.92
40-50	1	1.92
50-60	-	-
60-70	2	3.85
70-80	-	-
>80	4	7.69
Total	52	100

Table 11: Distribution of respondents according to the selled quantity

Quantities selled/annually	Frequency	%
<10	41	78.85
10-20	4	7.69
20-30	1	1.92
30-40	-	-
40-50	1	1.92
50-60	1	1.92
60-70	1	1.92
>70	3	5.77
Total	52	100

Table 12: Distribution of respondents according to the place of collection

Place of collection	Frequency	%
Family land	10	19.23
Gifar land	33	63.46
Forest	6	11.54
Other	3	5.77
Total	52	100

Table 13: Distribution of respondents according to the time of collection

Time of collection	Frequency	%
Morning	41	78.85
Midday	5	9.62
Evening	6	11.54
Total	52	100

Table 14: Distribution of respondents
according to the time spent in collection

Time/hour	Frequency	%
<2	4	7.69
2-4	9	17.31
4-6	19	36.54
6-8	14	26.92
8-10	5	9.62
10-12	1	1.92
Total	52	100

Table 15: Distribution of respondents
according to the frequency of collection

Frequency of collection	Frequency of families	%
1-10	38	73.08
11-20	9	17.31
21-30	2	3.85
31-40	2	3.85
>41	1	1.92
Total	52	100

Table 16: Distribution of respondents
according to the consumed quantity

Quantity consumed	Frequency	%
<10	23	44.23
10-20	8	15.38
20-30	7	13.46
30-40	4	7.69
40-50	3	5.77
50-60	-	-
60-70	3	5.77
>70	4	7.69
Total	52	100

Table17: Distribution of respondents
according to the revenue from selling the product

Revenue	Frequency	%
<100	41	78.85
100-200	7	13.46
200-300	2	3.85
300-400	1	1.92
400-500	1	1.92
Total	52	100

Table 18: Distribution of respondents according to the product parts used

Parts use	Frequency	%
Leaves	9	17.31
Fruits	43	82.69
Total	52	100

Table 19: Distribution of respondents according to the uses of the product

Uses	Frequency	%
Food & drink	44	84.62
Medicine	8	15.38
Total	52	100

Appendix 5: Characreistics of the families participated efficiently in Laloub collection in Shiekan Province.

Table 1: Distribution of respondents according to their age-groups.

Age- group	Frequency	%
25-30	7	12.07
30-35	9	15.52
35-40	7	12.07
40-45	7	12.07
45-50	9	15.52
50-55	6	11.54
55-60	1	1.72
60-65	7	12.07
65-70	4	7.69
>75	1	1.72
Total	58	100

Table 2: Distribution of respondents according to their sex.

Sex	frequency	%
Male	23	39.66
Female	35	60.34
Total	58	100

Table 3: Distribution of respondents according to the position in household

Position inhousehold	Frequency	%
Household head	32	55.17
Dependent	26	44.83
Total	58	100

Table 4: Distribution of respondents according to the marital status

Marital status	Frequency	%
Married	42	72.41
Single	16	27.59
Total	58	100

Table 5: Distribution of respondents according to the education level

Education	Frequency	%
Primary/Secondary	17	29.31
Illiterate	41	70.69
Total	58	100

Table 6: Distribution of respondents according to their income

Income group/000 SP.	Frequency	%
< 400	8	13.79
400-800	16	27.59
800 – 1200	9	15.52
1200- 1600	10	17.24
1600- 2000	3	5.17
2000-2400	2	3.45
2400-2800	2	3.45
2800-3200	3	5.17
> 3200	5	15.52
Total	58	100

Table 7: Distribution of respondents according to their main occupation

Occupation	Frequency	%
Farmer	53	91.38
Housewife	5	8.62
Total	58	100

Table 8: Distribution of respondents according to the family size

No.of family members	Frequency	%
1-3	6	10.34
4-6	27	46.55
7-9	20	34.48
10-12	5	8.62
Total	58	100

Table 9: Distribution of respondents according to the tribe

Tribe	Frequency	%
Bedieria	21	36.21
Kinana	15	25.86
Tumam	12	20.69
Others	10	17.24
Total	58	100

Table 10: Distribution of respondents according to the quantities they collect

Quantities collected/annually/kg	Frequency	%
< 10	22	37.93
10-20	12	20.69
20-30	2	3.45
30-40	4	6.90
40-50	2	3.45
>50	16	27.59
Total	58	100

Table 11: Distribution of respondents according to the selled quantity

Quantities selled/annually	Frequency	%
<10	32	55.17
10-20	7	12.07
20-30	1	1.72
30-40	-	-
40-50	2	3.45
50-60	2	3.45
60-70	3	3.53
>70	11	18.97
Total	58	100

Table 12: Distribution of respondents according to the place of collection

Place of collection	Frequency	%
Family land	21	36.21
Gifar land	25	43.10
Other	12	20.69
Total	58	100

Table 13: Distribution of respondents according to the time of collection

Time of collection	Frequency	%
Morning	37	63.79
Midday	21	36.21
Total	58	100

Table 14: Distribution of respondents according to the time spent in collection

Time/hour	Frequency	%
<2	22	37.93
2-4	11	18.97
4-6	11	18.97
6-8	4	6.90
8-10	3	5.17
10-12	2	3.45
>12	5	8.62
Total	58	100

Table 15: Distribution of respondents according to the frequency of collection

Frequency of collection	Frequency of families	%
1-10	36	62.07
11-20	4	6.90
21-30	6	10.34
31-40	1	1.72
41-50	2	3.45
>50	9	15.52
Total	58	100

Table 16: Distribution of respondents according to the consumed quantity

Quantity consumed	Frequency	%
<10	48	82.76
10-20	4	6.90
20-30	2	3.45
30-40	1	1.72
>40	3	5.17
Total	58	100

Table17: Distribution of respondents according to the revenue from selling the product

Revenue	Frequency	%
<100	43	74.14
100-200	5	8.62
200-300	1	1.72
>300	9	15.52
Total	58	100

Table 18: Distribution of respondents according to the parts used of the product

Parts use	Frequency	%
Leaves	26	44.83
Fruits	32	55.17
Total	58	100

Table 19: Distribution of respondents according to the uses of the product

Uses	Frequency	%
Food & drink	28	48.28
Medicine	17	29.31
Fodder	7	12.07
Cosmotic	6	10.34
Total	58	100

Appendix 6: Characreistics of the families participated efficiently in Sannameka collection in Shiekan Province.

Table 1: Distribution of respondents according to their age-groups.

Age- group	Frequency	%
<25	2	6.06
25-30	2	6.06
30-35	2	6.06
35-40	4	12.12
40-45	3	9.09
45-50	5	15.15
50-55	3	9.09
55-60	4	12.12
60-65	3	9.09
>65	5	15.15
Total	33	100

Table 2: Distribution of respondents according to their sex.

Sex	frequency	%
Male	14	42.24
Female	19	57.76
Total	33	100

Table 3: Distribution of respondents according to the position in household

Position inhousehold	Frequency	%
Household head	19	57.76
Dependent	14	42.24
Total	33	100

Table 4: Distribution of respondents according to the marital status

Marital status	Frequency	%
Married	22	66.67
Single	11	33.34
Total	33	100

Table 5: Distribution of respondents according to the education level

Education	Frequency	%
Primary/Secondary	12	36.36
Illiterate	21	63.64
Total	33	100

Table 6: Distribution of respondents according to their income

Income group/000 SP.	Frequency	%
< 400	5	15.15
400-800	6	18.18
800 – 1200	9	27.27
1200- 1600	3	9.09
1600- 2000	3	9.09
2000-2400	1	3.03
2400-2800	1	3.03
2800-3200	1	3.03
> 3200	4	12.12
Total	33	100

Table 7: Distribution of respondents according to their main occupation

Occupation	Frequency	%
Farmer	30	90.91
Housewife	3	9.09
Total	33	100

Table 8: Distribution of respondents according to the family size

No.of family members	Frequency	%
1-3	5	15.15
4-6	12	36.36
7-9	13	39.39
10-12	3	9.09
Total	33	100

Table 9: Distribution of respondents according to the tribe

Tribe	Frequency	%
Bedieria	13	39.39
Kinana	7	21.21
Tumam	6	18.18
Manasra	4	12.12
Galabhawara	3	9.09
Total	33	100

Table 10: Distribution of respondents according to the quantities they collect

Quantities collected/annually/kg	Frequency	%
< 100	5	15.15
100-200	3	9.09
200-300	3	9.09
300-400	3	9.09
400-500	1	3.03
>500	18	54.54
Total	33	100

Table 11: Distribution of respondents according to the selled quantity

Quantities selled/annually	Frequency	%
<100	7	21.21
100-200	3	9.09
200-300	6	18.18
300-400	1	3.03
400-500	1	3.03
>500	15	45.45
Total	33	100

Table 12: Distribution of respondents according to the place of collection

Place of collection	Frequency	%
Family land	16	48.48
Gifar land	12	36.36
Forest	5	15.15
Total	33	100

Table 13: Distribution of respondents according to the time of collection

Time of collection	Frequency	%
Morning	26	78.79
Midday	7	21.21
Total	33	100

Table 14: Distribution of respondents according to the time spent in collection

Time/hour	Frequency	%
<2	9	27.27
2-4	8	24.24
4-6	3	9.09
6-8	3	9.09
8-10	4	12.12
>10	6	18.18
Total	33	100

Table 15: Distribution of respondents according to the frequency of collection

Frequency of collection	Frequency of families	%
1-10	15	45.45
11-20	6	18.18
21-30	4	12.12
31-40	3	9.09
>41	5	15.15
Total	33	100

Table 16: Distribution of respondents according to the consumed quantity

Quantity consumed	Frequency	%
<10	19	57.58
10-20	3	9.09
20-30	4	12.12
30-40	-	-
40-50	1	3.03
50-60	2	6.06
>60	4	12.12
Total	33	100

Table17: Distribution of respondents according to the revenue from selling the product

Revenue	Frequency	%
<100	16	48.48
100-200	2	6.06
200-300	2	6.06
300-400	4	12.12
400-500	2	6.06
>500	7	21.21
Total	33	100

Table 18: Distribution of respondents
according to the parts used of the product

Parts use	Frequency	%
Seeds	9	27.27
Fruits	24	72.73
Total	33	100

Table 19: Distribution of respondents
according to the uses of the product

Uses	Frequency	%
Food & drink	9	27.27
Medicine	24	72.73
Total	33	100

Appendix 7: Characreistics of the families participated efficiently in *Aradieb* collection in Shiekan Province.

Table 1: Distribution of respondents according to their age-groups.

Age- group	Frequency	%
<25	2	4.55
25-30	2	4.55
30-35	7	15.91
35-40	7	15.91
40-45	7	15.91
45-50	5	11.36
50-55	5	11.36
55-60	2	4.55
60-65	4	9.09
>65	3	6.82
Total	44	100

Table 2: Distribution of respondents
according to their sex.

Sex	frequency	%
Male	32	72.73
Female	12	27.27
Total	44	100

Table 3: Distribution of respondents
according to the position in household

Position inhousehold	Frequency	%
Household head	30	68.18
Dependent	14	31.82
Total	44	100

Table 4: Distribution of respondents according to the marital status

Marital status	Frequency	%
Married	34	77.27
Single	10	22.73
Total	44	100

Table 5: Distribution of respondents according to the education level

Education	Frequency	%
Primary/Secondary	11	25.00
Illiterate	33	75.00
Total	44	100

Table 6: Distribution of respondents according to their income

Income group/000 SP.	Frequency	%
< 400	9	20.45
400-800	8	18.18
800 – 1200	11	25.00
1200- 1600	5	11.36
1600- 2000	-	-
2000-2400	2	4.55
2400-2800	1	2.27
2800-3200	4	9.09
> 3200	4	9.09
Total	44	100

Table 7: Distribution of respondents according to their main occupation

Occupation	Frequency	%
Farmer	35	79.55
Housewife	9	20.45
Total	44	100

Table 8: Distribution of respondents according to the family size

No.of family members	Frequency	%
1-3	8	18.18
4-6	19	43.18
7-9	14	31.82
10-12	3	6.82
Total	44	100

Table 9: Distribution of respondents according to the tribe

Tribe	Frequency	%
Bedieria	11	25.00
Kinana	8	18.18
Tumam	7	15.91
Manasra	7	15.91
Galabahawara	5	11.36
Others	6	13.64
Total	44	100

Table 10: Distribution of respondents according to the quantities they collect

Quantities collected/annually/kg	Frequency	%
< 10	12	27.27
10-20	7	15.91
20-30	3	6.82
30-40	2	4.55
40-50	2	4.55
50-60	-	-
60-70	4	9.09
>70	14	31.82
Total	44	100

Table 11: Distribution of respondents according to the selled quantity

Quantities selled/annually	Frequency	%
<10	18	40.91
10-20	2	4.55
20-30	3	6.82
30-40	1	2.27
40-50	2	4.55
50-60	4	9.09
60-70	1	2.27
>70	13	29.55
Total	44	100

Table 12: Distribution of respondents according to the place of collection

Place of collection	Frequency	%
Gifar land	16	36.36
Forest	28	63.64
Total	44	100

Table 13: Distribution of respondents according to the time of collection

Time of collection	Frequency	%
Morning	32	72.73
Midday	8	18.18
Evening	4	9.09
Total	44	100

Table 14: Distribution of respondents according to the time spent in collection

Time/hour	Frequency	%
<2	10	22.73
2-4	11	25.00
4-6	5	11.36
6-8	4	9.09
8-10	5	11.36
>10	9	20.45
Total	44	100

Table 15: Distribution of respondents according to the frequency of collection

Frequency of collection	Frequency of families	%
1-10	19	43.18
11-20	7	15.91
21-30	7	15.91
31-40	5	11.36
>40	6	13.64
Total	44	100

Table 16: Distribution of respondents according to the consumed quantity

Quantity consumed	Frequency	%
<10	27	61.36
10-20	5	11.36
20-30	5	11.36
30-40	-	-
40-50	2	4.55
50-60	-	-
60-70	2	4.55
>70	3	6.82
Total	44	100

Table17: Distribution of respondents
according to the revenue from selling the product

Revenue	Frequency	%
<100	34	77.27
100-200	4	9.09
200-300	2	4.55
>300	4	9.09
Total	44	100

Table 18: Distribution of respondents
according to the parts used of the product

Parts use	Frequency	%
Leaves	8	18.18
Fruits	32	72.73
Seeds	4	9.09
Total	44	100

Table 19: Distribution of respondents
according to the uses of the product

Uses	Frequency	%
Food & drink	29	65.91
Medicine	13	29.55
Fodder	2	4.55
Total	44	100

Appendix 8: Characreistics of the families participated efficiently in *Gudiem* collection in Shiekan Province.

Table 1: Distribution of respondents according to their age-groups.

Age- group	Frequency	%
<30	6	15.79
30-35	2	5.26
35-40	4	10.53
40-45	5	13.16
45-50	8	21.05
50-55	6	15.79
55-60	1	2.63
60-65	2	5.26
65-70	1	2.63
70-75	3	7.89
Total	38	100

Table 2: Distribution of respondents according to their sex.

Sex	frequency	%
Male	12	31.58
Female	26	68.42
Total	38	100

Table 3: Distribution of respondents according to the position in household

Position inhousehold	Frequency	%
Household head	20	52.63
Dependent	18	47.37
Total	38	100

Table 4: Distribution of respondents according to the marital status

Marital status	Frequency	%
Married	29	65.91
Single	9	34.09
Total	38	100

Table 5: Distribution of respondents according to the education level

Education	Frequency	%
Primary/Secondary	11	28.95
Illiterate	27	71.05
Total	38	100

Table 6: Distribution of respondents according to their income

Income group/000 SP.	Frequency	%
< 400	8	21.05
400-800	10	26.32
800 – 1200	10	26.32
1200- 1600	6	15.79
1600- 2000	2	5.26
> 2000	2	5.26
Total	38	100

Table 7: Distribution of respondents according to their main occupation

Occupation	Frequency	%
Farmer	35	92.11
Housewife	3	7.89
Total	38	100

Table 8: Distribution of respondents according to the family size

No.of family members	Frequency	%
1-3	12	31.58
4-6	13	34.21
7-9	11	28.95
10-12	2	5.26
Total	38	100

Table 9: Distribution of respondents according to the tribe

Tribe	Frequency	%
Bedieria	26	68.42
Kinana	5	13.16
Tumam	4	1.05
Others	3	7.89
Total	38	100

Table 10: Distribution of respondents according to the quantities they collect

Quantities collected/annually/kg	Frequency	%
< 10	23	60.53
10-20	8	21.05
20-30	2	5.26
30-40	1	2.63
40-50	1	2.63
50-60	1	2.63
>60	2	5.26
Total	38	100

Table 11: Distribution of respondents according to the selled quantity

Quantities selled/annually	Frequency	%
<10	30	78.95
10-20	4	10.53
>20	4	10.53
Total	38	100

Table 12: Distribution of respondents according to the place of collection

Place of collection	Frequency	%
Gifar land	6	15.89
Family land	32	84.21
Total	38	100

Table 13: Distribution of respondents according to the time of collection

Time of collection	Frequency	%
Morning	29	76.32
Midday	7	18.42
Evening	2	5.26
Total	38	100

Table 14: Distribution of respondents according to the time spent in collection

Time/hour	Frequency	%
<2	16	42.11
2-4	8	21.05
4-6	6	15.79
6-8	4	10.53
>8	4	10.53
Total	38	100

Table 15: Distribution of respondents according to the frequency of collection

Frequency of collection	Frequency of families	%
1-10	18	47.37
11-20	9	23.68
21-30	8	21.05
>30	3	7.89
Total	38	100

Table 16: Distribution of respondents according to the consumed quantity

Quantity consumed	Frequency	%
<10	36	94.74
10-20	2	5.26
Total	38	100

Table17: Distribution of respondents
according to the revenue from selling the product

Revenue	Frequency	%
<100	34	89.47
>100	4	10.53
Total	38	100

Table 18: Distribution of respondents
according to the parts used of the product

Parts use	Frequency	%
Leaves	8	21.05
Fruits	25	65.79
Seeds	5	15.79
Total	38	100

Table 19: Distribution of respondents
according to the uses of the product

Uses	Frequency	%
Food & drink	18	47.37
Medicine	16	42.11
Fodder	4	10.53
Total	38	100

Appendix 9: Characreistics of the families participated efficiently in *Garad* collection in Shiekan Province.

Table 1: Distribution of respondents according to their age-groups.

Age- group	Frequency	%
<25	1	4.55
25-30	3	13.64
30-35	1	4.55
35-40	1	4.55
40-45	5	22.73
45-50	2	9.09
50-55	4	18.18
55-60	-	-
60-65	1	4.55
65-70	1	4.55
70-75	1	4.55
75-80	2	9.09
Total	22	100

Table 2: Distribution of respondents according to their sex.

Sex	frequency	%
Male	7	31.82
Female	15	68.18
Total	22	100

Table 3: Distribution of respondents according to the position in household

Position inhousehold	Frequency	%
Household head	10	45.45
Dependent	12	54.55
Total	22	100

Table 4: Distribution of respondents according to the marital status

Marital status	Frequency	%
Married	19	86.36
Single	3	13.64
Total	22	100

Table 5: Distribution of respondents according to the education level

Education	Frequency	%
Primary/Secondary	3	13.64
Illiterate	19	86.36
Total	22	100

Table 6: Distribution of respondents according to their income

Income group/000 SP.	Frequency	%
< 400	3	13.64
400-800	6	27.27
800 – 1200	5	22.73
1200- 1600	3	13.64
1600- 2000	1	4.55
2000-2400	3	13.64
> 2400	1	4.55
Total	22	100

Table 7: Distribution of respondents according to their main occupation

Occupation	Frequency	%
Farmer	20	90.91
Housewife	2	9.09
Total	22	100

Table 8: Distribution of respondents according to the family size

No.of family members	Frequency	%
1-3	4	18.18
4-6	9	40.91
7-9	6	27.27
10-12	3	13.64
Total	22	100

Table 9: Distribution of respondents according to the tribe

Tribe	Frequency	%
Bedieria	7	31.82
Kinana	9	40.91
Tumam	6	27.27
Total	22	100

Table 10: Distribution of respondents according to the quantities they collect

Quantities collected/annually/kg	Frequency	%
< 100	7	31.82
100-200	4	18.18
200-300	2	9.09
300-400	2	9.09
400-500	1	4.55
500-600	1	4.55
600-700	2	9.09
>700	3	13.64
Total	22	100

Table 11: Distribution of respondents according to the selled quantity

Quantities selled/annually	Frequency	%
<100	9	40.91
100-200	3	13.64
200-300	3	13.64
300-400	2	9.09
400-500	1	4.55
>500	4	18.18
Total	22	100

Table 12: Distribution of respondents according to the place of collection

Place of collection	Frequency	%
Family land	3	13.64
Gifar land	12	54.55
Forest	7	31.72
Total	22	100

Table 13: Distribution of respondents according to the time of collection

Time of collection	Frequency	%
Morning	16	72.73
Midday	4	18.18
Evening	2	9.09
Total	22	100

Table 14: Distribution of respondents according to the time spent in collection

Time/hour	Frequency	%
<2	6	27.27
2-4	3	13.64
4-6	4	18.18
6-8	2	9.09
8-10	2	9.09
10-12	1	4.55
>12	4	18.18
Total	22	100

Table 15: Distribution of respondents according to the frequency of collection

Frequency of collection	Frequency of families	%
1-10	16	72.73
11-20	2	9.09
21-30	1	4.55
>30	3	13.64
Total	22	100

Table 16: Distribution of respondents according to the consumed quantity

Quantity consumed	Frequency	%
<10	13	59.09
10-20	3	13.64
20-30	-	-
30-40	1	4.55
40-50	2	9.09
50-60	1	4.55
>60	2	9.09
Total	22	100

Table17: Distribution of respondents
according to the revenue from selling the product

Revenue	Frequency	%
<100	7	31.82
>100	15	68.18
Total	22	100

Table 18: Distribution of respondents
according to the parts used of the product

Parts use	Frequency	%
Fruits	12	54.55
Seeds	10	45.45
Total	22	100

Table 19: Distribution of respondents
according to the uses of the product

Uses	Frequency	%
Food & drink	9	40.91
Medicine	13	59.09
Total	22	100

Appendix 10: Characreistics of the families participated efficiently in the recreation activities in Shiekan Province.

Table 1: Distribution of respondents according to their age-groups.

Age- group	Frequency	%
<30	7	13.46
30-35	4	7.69
35-40	7	13.46
40-45	4	7.69
45-50	9	17.31
50-55	6	11.54
55-60	2	3.85
60-65	6	11.54
65-70	7	13.46
Total	52	100

Table 2: Distribution of respondents
according to their sex.

Sex	frequency	%
Male	16	30.77
Female	36	69.23
Total	52	100

Table 3: Distribution of respondents according to the marital status

Marital status	Frequency	%
Married	37	71.15
Single	15	28.85
Total	52	100

Table 4: Distribution of respondents according to the education level

Education	Frequency	%
Primary/Secondary	8	15.38
Illiterate	44	84.62
Total	52	100

Table 5: Distribution of respondents according to their income

Income group/000 SP.	Frequency	%
< 500	4	7.69
500-1000	8	15.38
1000 – 1500	7	13.46
1500- 2000	14	26.92
2000- 2500	4	7.69
2500-3000	3	5.77
3000-3500	2	3.85
3500-4000	1	1.92
>4000	9	17.31
Total	52	100

Table 6: Distribution of respondents according to their main occupation

Occupation	Frequency	%
Farmer	50	96.15
Housewife	2	3.85
Total	52	100

Table 7: Distribution of respondents according to the tribe

Tribe	Frequency	%
Bedieria	18	34.62
Kinana	10	19.23
Tumam	11	21.15
Manasra	8	15.38
Galabahawara	5	9.62
Total	52	100